How negative aspiration performance gaps affect innovation efficiency

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Abstract

By taking insights from the behavioral theory, this study analyzes how performing below aspiration levels influences innovation efficiency. Furthermore, this research analyzes whether firms respond differently to performance pressures depending on certain factors at the organizational

level, such as financial slack and family management. Conducting a panel data analysis on 3116 observations of Spanish manufacturing firms over the 2001–2013 period, we find that performing below aspiration levels improves the firm's conversion rate of innovation efficiency in both the short and the long term. Furthermore, this study confirms that two contingencies, namely the levels of financial slack and family management, are quite relevant towards gaining a full understanding of the complex nuances associated with the investigated core relationship.

Keywords

Innovation efficiency
Aspiration performance gaps
Unabsorbed slack
Family management
Behavioral agency model
Rigidity-threat thesis

JEL classifications

O31
O32
M19
L26

1. Introduction

The efficiency with which technological innovation (henceforth, TI) is undertaken is a key to increasing firm performance (Cruz-Cázares et al. 2013), hence its importance in the innovation field (Greco et al. 2017; Hong et al. 2016; Qin and Du 2017). TI efficiency is defined as the relative capability of a firm to obtain innovation outputs given a certain quantity of innovation inputs (Cruz-Cázares et al. 2013), which, in our case, is operationalized as the impact of firms' R&D investments on the achievement of TI.

Previous literature on innovation has analyzed different factors, both internal (i.e., CEO power, absorptive capacity…) and external (i.e., government grants, regional environment…), as antecedents of innovation efficiency (e.g. Qiao and Fung 2016; Qin and Du 2017; Wang et al. 2016). Nevertheless, the abovementioned studies leave research open to enhance prior knowledge of a

central concern in strategic management: understanding the sources of innovation efficiency heterogeneity.

Prior research based on the behavioral theory (Cyert and March 1963) has confirmed that in the face of performance pressures, managers implement organizational changes searching for solutions—problemistic search—that can raise expected performance to the aspiration level, such as, for example, developing specific R&D strategies (Bolton 1993). Under these circumstances, decision-makers are more likely to increase R&D expenses and innovation launches (Chen 2008; Giachetti and Lampel 2010; Greve 2003a; Vissa et al. 2010), increasing the magnitude and frequency of R&D. Furthermore, slack and the dominant coalition have been shown to be key concepts in behavioral theory that affect firms' decision-making (Argote and Greve 2007).

On the one hand, slack is designated as the pool of resources that is in excess of the minimum necessary to sustain routine operations (Vanacker et al. 2016), facilitates strategic behavior in organizations (Bourgeois 1981), and increases innovativeness (Argote and Greve 2007). Moreover, slack has been proved to have a positive effect on innovation investments in the face of economic difficulties (Zona 2012).

On the other hand, families are significant coalitions in family firms (Chrisman et al. 2012; Chua et al. 1999), and therefore, the family's involvement in the firm allows the pursuit of family-related strategies and goals.

Although innovation literature has investigated some of the most significant determinants of innovation efficiency (i.e., Broekel 2015) and even though past and peer performance has been considered an important context in which to frame strategic decisions (Iyer and Miller 2008; Miller and Chen 1994), such as innovation decisions (Kotlar et al. 2013, 2014a, b), to the best of our knowledge, no study has analyzed whether organizations under performance pressures will shift towards using innovation resources more efficiently. In this vein, our contention is that innovation efficiency research must include another important factor, namely performing below aspiration levels, that encourages managers to pursue changes and motivates them to start discussions and search, resulting in innovation efficiency gains. In such a way, innovation efficiency heterogeneity would be better understood.

Furthermore, this research analyzes whether firms respond differently to performance pressures depending on certain factors at the organization level,

such as financial slack and family management. When, and to what extent, slack and family involvement affect innovation efficiency is an under-researched topic in previous literature (e.g., Diéguez-Soto et al. 2016b, 2017; Duran et al. 2015). In this sense, we believe that recognizing that slack and family management can influence innovation efficiency, when performance is below aspiration levels, helps to explain why organizational rates of innovation efficiency may hugely change across firms as well as over time.

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To test the abovementioned relationships, we developed an empirical study with different econometric models that cover the hypotheses, using a panel data sample of 3116 observations of Spanish manufacturing enterprises covering the period from 2001 to 2013. The data were obtained from the Spanish Survey on Business Strategies. The longitudinal character of this dataset allows us to explain innovation efficiency variations over time in response to negative performance feedbacks, which also supports the choice of the behavioral theory as the theoretical perspective of this study.

This research makes multiple contributions to the extant literature on innovation efficiency and represents an important refinement, both in terms of theory development and theory testing (Colquitt and Zapata-Phelan 2007), of the behavioral theory, as it examines the unexplored relationship between performing below aspiration levels and innovation efficiency. Furthermore, this article analyzes two significant moderating factors in the abovementioned relationship by investigating how firms respond differently to performance pressures depending on the level of financial slack and family management. Additionally, this study extends current theory by researching the extent to which performance below aspirations has different consequences on innovation efficiency in different time horizons. In summary, our study finds, in general terms, that performing below aspiration levels augments the rate of innovation efficiency in both the short and the long term. Furthermore, this research confirms that two contingencies, namely the levels of financial slack and family management, are quite relevant to fully understanding complex nuances associated with the investigated core relationship, thereby also contributing to the family business research field.

This paper proceeds as follows. In Sections 2 and 3, we present the theoretical background and hypotheses development. Subsequently, Sections 4 and 5 cover the methodology and the results. Section 6 shows the estimation of the

robustness checks. Finally, Section 7 includes the discussion and conclusions.

2. Theoretical background

Previous innovation literature has examined both the antecedents and the effects of innovation efficiency in order to have a well-rounded understanding of this concept. Basically, regarding the consequences of innovation efficiency, researchers agree with the idea that the mere fact of having resources—R&D—does not ensure either innovation generation or superior performance (Song et al. 2007; Chiesa and Frattini 2009); indeed, the key to increasing firm performance is the efficiency with which the innovation process is undertaken (Cruz-Cázares et al. 2013). Similarly, innovation efficiency affects firm valuation in the global market. Specifically, innovation efficiency has been proved to enhance firm valuation in different institutional and business environments (Gao and Chou 2015).

Concerning the antecedents, prior research has found some factors influencing innovation efficiency (i.e., government grants, regional innovation environment...). Most of the previous studies consider regions (Broekel 2015; Franco et al. 2016; Qin and Du 2017; Wang et al. 2016), industries (Hong et al. 2016), and public companies (Qiao and Fung 2016) as the research subject. Moreover, the majority of studies are conducted in a Chinese context (Hong et al. 2016; Qin and Du 2017; Wang et al. 2016) and are concerned with factors that explain cross-sectional differences among firms (Greco et al. 2017; Jansen et al. 2005; among others). Thus, innovation efficiency has not been analyzed in a Western context, nor considering private firms, neither using longitudinal analysis. Furthermore, to the best of our knowledge, the previous literature has not addressed the influence of performance on innovation efficiency.

However, past and peer performance has been considered an important reference point for future decisions, inasmuch as relating decisions and contexts provides a better comprehension of organizational decision processes (House et al. 1995; Sitkin and Pablo 1992; Shimizu 2007). Particularly, according to the behavioral theory of the firm (Cyert and March 1963), concepts such as aspiration levels, performance feedback, and problemistic search lead to the prediction of organizational change (Argote and Greve 2007; Gavetti et al. 2012). Thus, problemistic search indicates that aspiration levels adjust to past performance levels (historical aspiration level) and the recent performance of other firms (social aspiration levels) (Chrisman and Patel 2012; Lant 1992).

Once firm performance falls below the aspiration level, managers will implement organizational changes, searching for solutions that can raise expected performance to the aspiration level (Cyert and March 1963). In that sense, behavioral theory hypotheses refer to short-term, incremental adjustments to relatively small performance gaps (Bromiley et al. 2001; Cyert and March 1963; Miller and Chen 1994).

Accordingly, we develop our arguments using the behavioral theory to investigate how performing below aspiration levels impacts on innovation efficiency. In this vein, and despite the expected overall innovation efficiency-enhancing effect, the influence of performance below aspiration levels is not likely to be always the same. Rather, we assume that firms are supposed to differ in the extent to which they take advantage from performing below aspiration levels. We thus sustain a contingency perspective of negative aspiration performance gaps and analyze the extent to which the influence of performing below aspiration levels is contingent on some important organizational factors, such as slack and family involvement in management.

On the one hand, slack is defined as a pool of resources that is in excess of the minimum necessary to sustain routine operations (Vanacker et al. 2016). Actually, slack is a central concept in behavioral theory (Cyert and March 1963) and has been argued to have positive benefits as a facilitator of strategic behavior in organizations (Bourgeois 1981) and as an innovativeness precursor (Argote and Greve 2007). Thus, slack describes potentially utilizable resources that can be diverted or redeployed for the achievement of organizational goals, creating funds that can be redirected towards projects with uncertain outcomes, fostering an environment for innovation (George 2005). Similarly, and independently of the levels, combinations or configurations of slack (Marlin and Geiger 2015), researchers have found a positive relationship between slack and innovation (Creenhalgh 1983; Mansfield 1961; Zona 2012) and between slack and R&D investments (Chrisman and Patel 2012). Authors have confirmed a favorable impact of slack on the use of capabilities, innovation (Parida and Örtqvist 2015), and performance (Daniel et al. 2004; George 2005; Vanacker et al. 2016). Salge (2011) has also showed that innovations occur more frequently in organizations with low performance and high slack.

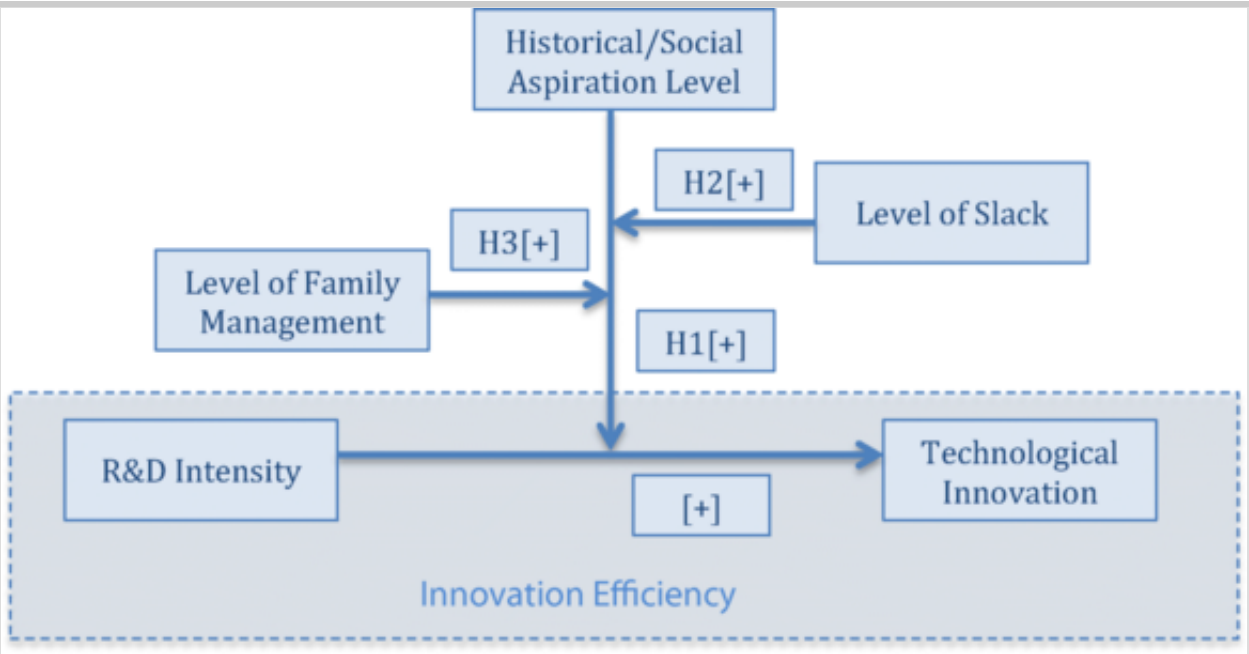
On the other hand, behavioral theory also establishes how the organization can have goals resulting from the interaction of coalitions (Cyert and March 1963). Firm strategies, decision-making, routines, and processes (Argote and Greve

2007) can reflect the interests, concerns, and preferences of those managers in the dominant coalition (Hambrick and Mason 1984). As the family involves a very significant coalition in the family firm, the family identification with the ownership, management, and governance of the firm leads to unique goals, behaviors, and performance outcomes (Chrisman et al. 2005). Furthermore, behavioral view has been utilized as the basis for stating that family firms are more inclined to pursue emotional goals (Astrachan and Jaskiewicz 2008; Zellweger and Astrachan 2008), accentuate the generation and preservation of socioemotional wealth (Gómez-Mejia et al. 2007), and perform altruistic behavior towards family members (Lubatkin et al. 2005). Thus, there is accumulating evidence that family involvement in firms conducts to distinctive behaviors, problem framing, and strategic choices (Chrisman et al. 2003; Kotlar et al. 2013). Specifically, non-economic goals may govern strategic decisions in family-managed firms, such as innovative choices (Chrisman and Patel 2012; Classen et al. 2014; De Massis et al. 2013).

Consequently, organizational characteristics, such as financial slack and family involvement in management, might influence the effects of performance below aspiration levels on innovation efficiency in different time horizons. Therefore, by linking innovation efficiency and behavioral theory, our study investigates the role of negative performance-aspiration gaps in driving innovation efficiency. Similarly, and drawing on key concepts and mechanisms discussed in the behavioral theory of the firm, such as slack search and dominant coalition, we also investigate the moderating role of these concepts in the relationship between below aspiration level of performance and innovation efficiency (Fig. 1).

Fig. 1

Theoretical framework



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3. Hypotheses development

3.1. Innovation efficiency and negative aspiration performance gaps

Investments in R&D promote TI and are crucial to improve resource efficiency (Baumann and Kritikos 2016). Thus, becoming more innovative through the introduction of R&D investments may augment the stock of knowledge and enhance the firm's output by increasing productivity (Hall et al. 2010).

The requirement of efficiently obtaining TI from R&D expenses becomes even more relevant when firms' performance is below the aspiration levels, as in these cases firms need to respond more effectively to environmental contingencies (Bolton 1993). Performance below the aspiration levels affects outcomes such as the overall firm strategy (Lant 1992; Miller and Chen 1994; Audia et al. 2000) and also specific strategies such as R&D (Bolton 1993). Particularly, under such circumstances, managers are more likely to increase R&D expenses and innovation launches (Chen 2008; Giachetti and Lampel 2010; Greve 2003a; Vissa et al. 2010). The greater the R&D expenses, the higher the critical mass of R&D (Geroski 1998; Kancs and Siliverstovs 2016), and thus, the greater possibilities of increasing innovation efficiency. In short, a positive effect emerges through scale economies when larger R&D investments create significantly more knowledge than smaller projects (Ahuja 2000). In the end, investing more in R&D implies augmenting the likelihood of improving

technological innovation efficiency.

Firm managers, in seeking to improve the organizational performance, are more likely to search for better resource allocation. By examining and analyzing the sources of low performance, firm members may create new knowledge regarding the way to prevent equivalent mistakes or enhance performance outcomes (Sorenson 2003). Similarly, firm managers, by investigating the causes of poor performance, may also induce changes in firm routines and processes, resulting in production design changes or increased expenses in employee training that improve innovation efficiency (Desai 2010). Furthermore, organizations may accumulate knowledge and experience from these events (Levitt and March 1988), which are utilized to identify and alleviate incidents that may diminish firm performance in the future (Desai 2010). This new knowledge generated from hard experience may be stored within the firm to help it face similar problems in the future, spurring innovation efficiency throughout the life of the organization (March 1991). Thus, thorough organizational learning firms usually achieve to improve their activities and enhance their operating efficiency (Argote and Greve 2007).

Moreover, when managers find that organizational performance is below aspirational levels, they invest in the development of capabilities to obtain and assimilate external knowledge (Winter 2000) and to better implement the existing knowledge (Ben-Oz and Greve 2015). Thus, when performance falls below aspiration levels, organizations increase their efforts to acquire new knowledge through learning processes that augment absorptive capacity (Chaudhuri and Tabrizi 1999; Kim 1998) and improve flexibility and innovation capabilities, which in turn affects innovation efficiency and firm performance (Zahra and George 2002).

Similarly, firms do not only learn from their own experiences but also from other businesses' experiences (Levitt and March 1988). Thus, organizations performing below aspiration levels might be more willing to accept the risk of non-local ties with unfamiliar organizations—dancing with strangers—in order to have efficient access to the diverse information across regions of the network for a chance to enhance their performance (Baum and Rowley 2005). A large innovative network is likely to bring advantages such as resource sharing, knowledge spillovers, and scale economies, which might increase technological innovation efficiency. Resource sharing benefits come from the transfer of know-how, skills, and physical assets. Knowledge spillover benefits relate to

communicating news of technical breakthroughs, new insights to problems, or failed approaches. Collaborations, through ties with partners, enable organizations to take advantage of scale economies, increasing the generation of more knowledge (Ahuja 2000).

Thus, we argue that, below aspiration levels of performance, decision-makers develop specific actions to solve the performance problem, such as R&D investments, searching for solutions, and organizational changes that improve performance. Thereby, they are willing to invest more in R&D and simultaneously make more effective use of their resources, leading, in both cases, to an increased efficiency in the conversion of R&D into TI.

Therefore, we propose:

> **Hypothesis 1**: Performance below aspiration levels strengthens the positive effect of R&D intensity on the likelihood of obtaining TI -innovation efficiency-.

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3.2. Innovation efficiency, negative aspiration performance gaps, and the level of financial slack

We have hypothesized in the former section that firms under performance pressures are likely to increase innovation efficiency. Herein, we argue that firms may respond differently to such pressures depending on financial slack. As mentioned previously, poor performance prompts organizations to increase R&D investments generating scale economies (Ahuja 2000), to learn and to generate new knowledge (Levitt and March 1988), to increase absorptive capacity (Kim 1998), and to enhance their collaboration networks (Baum and Rowley 2005), which, in turn, may contribute to improve innovation efficiency. Although these consequences of performing below aspiration levels may improve technological innovation efficiency, having financial slack can strengthen these positive effects by directing these resources towards the requested objectives, making strategic decisions more flexible (Yang et al. 2014).

Drawing on behavioral view, slack resources enable firms to augment search, creating possibilities for changes (Cyert and March 1963). Thus, the presence of financial slack may ease search resulting in major changes in strategy (Iyer and Miller 2008), such as undertaking R&D investments, making scale economies

more likely. On the contrary, at low levels of slack, the probability of rising R&D investments will decrease, diminishing the likelihood of scale economies radically and thereby their positive effects on innovation efficiency.

Likewise, having enough financial slack allows firms to invest in incremental learning capabilities (Voss et al. 2008) and provides the firm with proper flexibility and autonomy to carry out problem detection, idea suggestion, and change implementation (Singh 1986). Having unabsorbed slack contributes to building, preserving, and exercising those learning capabilities (Salge and Vera 2013) that emerged due to performing below aspiration level. With the support of financial slack, changes in routines, beliefs, procedures, tools, and the rate of technological improvements may be facilitated (Yang et al. 2014). Conversely, if slack is scant, learning capabilities may be lacking within the organization, because these capabilities are highly resource-intensive (Salge and Vera 2013).

Moreover, the organization's ability to use external knowledge through the subsequent processes of exploratory, transformative, and exploitative learning (Lane et al. 2006) and acquiring knowledge from different partners is resource consuming (Guo et al. 2015). Thus, accessing resources makes it possible to deploy network capability and resource-intensive joint projects to explore novel technologies (Parida and Örtqvist 2015). Therefore, financial slack is needed to support organizational learning, absorptive capacity, and external collaboration when performance is below aspiration levels.

Having financial slack means having accessible resources which can be allocated immediately and feeling secure to experiment and to explore (Nohria and Gulati 1996). Available slack may also be utilized to resolve conflicts over resources between tasks in innovation search (Wang et al. 2017) and may determine decisions to continue valuable and efficient R&D projects, which, during bad times and with low slack, would be aborted, due to strict performance monitoring of uncertain projects (Greve 2003b; Levinthal and March 1981; O'Brien 2003).

Thus, we argue that having financial slack, when a firm's performance is below aspiration levels, increases innovation efficiency. Then, taking into account these arguments, we posit that financial slack might act as a reinforcing factor in the R&D-TI relationship (Chrisman and Patel 2012) when firm's performance is below aspiration levels, and we propose:

Hypothesis 2: The level of financial slack will moderate the relationship

between performance below aspiration levels and the effect of R&D intensity on the likelihood of obtaining TI -innovation efficiency-, in such a way that performance below aspiration levels will have a more positive effect on innovation efficiency when the level of financial slack increases.

3.3. Innovation efficiency, negative aspiration performance gaps, and the level of family management

We have previously hypothesized that firms performing below aspiration levels are likely to increase their TI efficiency. Herein, we state that firms might respond distinctly to performance concerns contingent upon the level of family involvement in the business (Chrisman and Patel 2012; Kotlar et al. 2013; Patel and Chrisman 2014; Sciascia et al. 2015).

Accordingly, family-managed firms are less prone to invest in R&D (Block 2012; Chrisman and Patel 2012; Munari et al. 2010), but their investment preferences vary in accordance with the compatibility of family and business goals (Fuetsch and Suess-Reyes 2017; Sciascia et al. 2015). Namely, in situations where business performance expectations are fulfilled, family managers tend to accomplish exploitative R&D investments that increase the predictability and lower the variability of firm performance (Hayton et al. 2011; Patel and Chrisman 2014; Pittino et al. 2013).

However, when performance falls below the aspiration level, family managers are likely to trade their R&D strategies from options with lower risk and more reliable performance to ones with greater returns but simultaneously higher risk (March 1991; Mazzelli et al. 2018; Patel and Chrisman 2014). That is, when performance expectations are not achieved, family managers opt for exploratory investments that increase the firm's potential performance and its changeability. In this regard, exploratory projects are usually risky R&D investments, habitually featuring a lower probability of success but a higher payoff if they succeed (Färnastrand et al. 2012). Therefore, when performance is below aspiration levels, family managers are likely to reduce the obtaining of TI, weakening TI efficiency.

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In this vein, while explorative R&D emphasizes new technology development beyond a firm's current know-how and implies search, experimentation and variation, exploitative innovation focuses on both path-dependence and the

extension of the business' current knowledge, improving productivity and efficiency through choice, execution, and variance reduction (Chen et al. 2016; Lavie et al. 2010). Therefore, by pursuing an exploratory strategy when performance is below aspirations, family-managed firms are opting for researching new technologies and meeting the needs of emerging customers and markets (Benner and Tushman 2003), requiring new knowledge or departure from existing knowledge (Levinthal and March 1993). As a consequence, family-managed firms will have more difficulties to increase innovation efficiency through scale economies. Below-aspiration performance level leads family-managed firms to relegate exploitative R&D strategy, which is indeed built on existing expertise and augment current skills, process, and structures (Benner and Tushman 2002) and consequently may facilitate synergies and innovation efficiency in the end.

Moreover, family managers are reluctant to allow new members from outside the family to take control over strategic decisions as this involves losing control of their firms (Gómez-Mejia et al. 2007, 2010), even when performance is below aspiration levels (Kotlar et al. 2013). Thus, although technological collaboration networks and external knowledge acquisitions are associated with higher innovation efficiency (Ahuja 2000), family managers perceive these strategies as a cession of discretionary power over innovation activities to external parties and as a loss of control over the trajectory of future innovation developments. Such concerns might hinder collaborative relationships with external partners (Almirall and Casadesus-Masanell 2010; De Massis et al. 2013), reducing the possibilities of obtaining TI and thus reducing innovation efficiency. With this in mind, family managers are likely to avoid external knowledge acquisition and collaborative innovation network even in the face of negative performance feedbacks (Kotlar et al. 2013).

Based on the abovementioned arguments, we consider that family-managed firms will weaken the positive effect that performance below aspiration level exerts on the conversion rate of innovation input into TI. Stated formally:

> **Hypothesis 3**: The level of family management will moderate the relationship between performance below aspiration levels and the effect of R&D intensity on the likelihood of obtaining TI -innovation efficiency-, in such a way that performance below aspiration levels will have a weaker effect on innovation efficiency as the level of family management increases.

4. Methodology

4.1. Sample and data sources

The sample of 5304 firms that comprised the Survey on Business Strategies (ESEE) is used in this analysis. The ESEE is administrated by the State Partnership of Manufacturing Equity (SEPI) foundation on behalf of the Spanish Ministry of Industry and consists of manufacturing firms. The sampling procedure ensures the representativeness of the Spanish manufacturing sector. The data includes 13 years of observations: from 2001 to 2013. After removing firms with missing data for the analyzed variables, we matched each sampled firm with TI outputs with another one without TI outputs, based on size and industry. The matching was made for each year (see Table 1 for the distribution of pairs by year). The final sample comprises 3116 observations of Spanish private manufacturing firms (1558 with TI outputs and 1558 without TI outputs). A more descriptive view of the sample is reported in Table 1.

Table 1

Sample characteristics

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Number of firms per year		
Year	Firms in the population	Matched sample
2001	3462	314
2002	3462	262
2003	3462	232
2004	3462	254
2005	4050	242
2006	4357	232
2007	4475	272
2008	4629	226
2009	4851	216
2010	5040	214
2011	5040	210
2012	5304	220

2013	5304	222
Sample composition by industry		
Industry	*N*	Percent
1. Meat industry	130	4.17%
2. Foodstuffs and snuff	364	11.68%
3. Drinks	98	3.15%
4. Textiles and clothing	209	6.71%
5. Leather and footwear	57	1.83%
6. Timber industry	64	2.05%
7. Paper industry	165	5.30%
8. Graphics	99	3.18%
9. Chemical and pharmaceutical products	304	9.76%
10. Rubber and plastic	222	7.12%
11. Non-metallic mineral products	82	2.63%
12. Ferrous and non-ferrous metals	129	4.14%
13. Metal products	427	13.70%
14. Agricultural and industrial machinery	184	5.91%
15. Computer, electronic and optical products	52	1.67%
16. Electrical machinery and material	122	3.92%
17. Motor vehicles	220	7.06%
18. Other transport equipment	83	2.66%
19. Furniture industry	83	2.66%
20. Other manufacturing	22	0.71%
Total	**3116**	**100.00%** AQ7

4.2. Variables

Dependent variable: technological innovation

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TI is represented by the development of product and/or process (Freeman 1976) innovation. Particularly, for each year, we take the firms' managers' responses from two questions from the ESEE. One of them reports whether the firm obtained completely new products or made important changes to their products (product innovation). The other one is related to the introduction of significant changes in the production and/or distribution process (process innovation). We then assign a dummy variable, which is coded as 1 if the firm carried out either or both types of innovations (product or process innovation) and 0 otherwise. A similar approach is used in Yeh-Yun Lin and Yi-Ching Chen (2007) and, in Utterback and Abernathy (1975), among others.

Independent variable: R&D intensity

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As a proxy of innovation input, R&D intensity is the key variable in the regression model predicting TI. Following previous studies, R&D intensity is measured as total expenditure for R&D divided by total sales (Diéguez-Soto et al. 2016a; Gómez-Mejia et al. 2015; Schmid et al. 2014). As current R&D investment positively affects future innovation success in subsequent years, we use the one period lag R&D intensity variable, following Liang et al. (2013) and Wadhwa and Kotha (2006), among others.

4.3. Moderating variables

Performance below aspiration levels (negative aspiration performance gaps) In this study, we look at the moderating impact of performance below aspiration level on the relationship between R&D intensity and TI outputs. We use two measures of performance below aspiration level: historical and social (Gómez-Mejia et al. 2015; Iyer and Miller 2008). Performance below aspiration level based on historical comparisons is the decline in performance at $t-1$ relative to performance at $t-2$. The second proxy of aspiration level is based on the "social aspiration" of the firm. Firm's performance in period $t-1$ is compared with the performance of competitors for the same period. Using the two-digit SIC code, we calculate the median of the industry's performance. In both cases, we use return on assets ratio (ROA) as measure of performance. Following Gómez-Mejia et al. (2015), we take the absolute value of the previous differences if the result is negative; otherwise, positive values are replaced by 0. By doing so, we construct continuous censored variables to measure aspiration gaps, making it easier to interpret how deviations in performance impact on R&D investment (Chrisman and Patel 2012).

Slack In this paper, we also are interested in determining whether *slack* impacts on the moderating effect of performance below aspiration levels in the relationship between R&D intensity and the likelihood to achieve TI outputs. Similarly to Gómez-Mejia et al. (2015) and Iyer and Miller (2008), we use one of the measures proposed by Bourgeois and Singh (1983) as a proxy for unabsorbed slack—also known as financial slack: the ratio of current assets to current liabilities.

Family management We use family involvement in mnagement as a moderating variable. As family firms have other non-financial aims, relating to socioemotional or social issues (e.g. Gómez-Mejia et al. 2007; Martínez-Romero and Rojo-Ramírez 2016, 2017; among others), they are usually more risk averse than non-family managed firms. Accordingly, their performance aspiration levels could be different than those of their non-family managed counterparts.

In line with Kotlar et al. (2014a, b), we consider that a family controls the firm when their members are actively involved in both ownership and management. Accordingly, we define the level of family involvement as a continuous variable counting the number of family members involved in the senior management team of the firm. As this is a direct and objective measure of family involvement in management and, it is not rare in prior literature to use it as a proxy for family management (Kotlar et al. 2013), we consider it appropriate to test the hypotheses.

4.4. Control variables

As larger firms are more likely to increase the level of innovation because of their advantages in terms of market power, economic and financial resources, and internal knowledge (Cohen and Klepper 1996), we use *firm size* as a control variable, measured as the log of total assets. Furthermore, authors such as Baysinger and Hoskisson (1989) and Audia and Greve (2006) link the firm's size to the level of risk taking. As receiving subsidies for innovation may affect the achievement of innovation outputs (Raymond et al. 2010), we control for whether the firm has received subsidies. In this vein, the dummy variable *subsidies* equals one when the firm has received subsidies and zero otherwise. Due to some types of industries being more technology intensive and needing specific knowledge in the field in which they operate, we identify those *industries* with the highest levels of "technological opportunity"[1] (Baysinger and Hoskisson 1989). As the ability to create innovation may well depend on

the life stage of firm (Craig and Moores 2006), we also introduce *firm age* in the models, measured as the log of the time since the firm was founded. Additionally, we construct two binary variables for *performance above aspiration levels*, historical and social: 1 indicates that the difference is positive and the variable is set to 0 if the difference is negative. Finally, we included dummy variables to control for the *territorial specificities* or context conditions (Camagni and Capello 2013). To be precise, we include in our models dummy variables representing seven Spanish territorial subdivisions (NUTS1, *Nomenclature des Unités Territoriales Statistiques*).[2]

4.5. Data analysis method

As our dependent variable (TI) is dichotomous and we want to preserve the matched character of our sample (Mangena and Chamisa 2008), we use conditional logistic regression to estimate the parameters and test our hypotheses. In addition, and following Gómez-Mejia et al. (2015), all the predictor variables are lagged 1 year, because the innovation output is expected to be a lagged manifestation. Different models were estimated in order to test the hypotheses.

First, to understand better the moderating impact of performance below aspiration level on the relationship between R&D intensity and TI outputs (hypothesis 1), we defined the following model:

$$Technological\ innovation = \beta_1\ \text{R\&D}\ intensity_{t-1} + \beta_{21}\ Performance\ below\ aspirati$$

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As the level of slack might also moderate the impact of negative gaps in performance aspirations on the relationship between R&D intensity and TI outputs, we propose the following model to test Hypothesis 2.

$$Technological\ innovation = \beta_1\ R\&D\ intensity_{t-1} + \beta_{21}\ Performance\ below\ aspirati$$

Finally, to analyze the moderating role of family management in the previous relationship (Hypothesis 3), we add a three-way interaction to the model proposed in Eq. (1).

$$Technological\ innovation = \beta_1\ R\&D\ intensity_{t-1} + \beta_{21}\ Performance\ below\ aspirati$$

5. Results

Means, standard deviations, and *t* tests of mean differences for continuous variables and frequencies for categorical variables are shown in Table 2.

Table 2

Descriptive statistics

Continuous variables								
Variables	Innovator firms					Non-innovator firm		
	Mean	Median	25%	75%	Std. dev.	Mean	Median	
R&D intensity$_{t-1}$	1.234	0.294	0.001	1.220	3.572	0.568	0.001	
Performance below aspiration level (historical aspirations)$_{t-1}$	0.037	0.000	0.000	0.036	0.092	0.035	0.000	
Performance below aspiration level (social aspirations)$_{t-1}$	0.047	0.009	0.000	0.067	0.096	0.047	0.011	
Family management$_{t-1}$	0.672	0.000	0.000	1.000	0.972	0.598	0.000	
Unabsorbed slack$_{t-1}$	2.453	2.056	1.422	2.959	1.768	2.501	1.983	
Firm size	16.578	1.629	15.091	17.923	1.937	16.403	16.482	
Firm age	3.300	3.367	2.890	3.784	0.765	3.190	3.296	
Performance over aspiration level (historical aspirations)$_{t-1}$	0.046	0.000	0.000	0.042	0.126	0.046	0.000	
Performance over aspiration level (social aspirations)$_{t-1}$	0.098	0.067	0.031	0.121	0.138	0.096	0.064	
Categorical variables								

	Innovator firms		Non-innovator firms				
	N	Percent	*N*	Percent			
Subsidies	305	19.58%	100	6.42%			
Non-subsidies	1253	80.42%	1458	93.58%			
Technological opportunity industry	346	22.21%	345	22.14%			
Non-technological opportunity industry	1212	77.79%	1213	77.86%			
Geographical localization							
Northwest	258	15.01%	273	15.88%			
Northeastern	182	10.59%	166	9.66%			
Madrid	217	12.62%	264	15.36%			
Center	219	12.74%	235	13.67%			
East	710	41.30%	597	34.73%			
South	116	6.75%	146	8.49%			
Canarias	17	0.99%	38	2.21%			
$*p < 0.10$; $**p < 0.05$; $***p < 0.01$							

Correlations and the results of the multicollinearity analysis show that multicollinearity between independent variables is not a concern in our study (see Table 3). All bivariate correlations are below 0.5 and VIF values are lower than 2.5 (multicollinearity results are available from the authors), which is the warning level proposed in previous studies (Hair et al. 1998).

Table 3

Correlation matrix

Variables	**1**	**2**	**3**	**4**	**5**	**6**
1. Technological innovation	1					

2. R&D intensity$_{t-1}$	0.109***	1				
3. Performance below aspiration level (historical aspirations)$_{t-1}$	0.011	− 0.023	1			
4. Performance below aspiration level (social aspirations)$_{t-1}$	0.002	0.003	0.385***	1		
5. Unabsorbed slack$_{t-1}$	− 0.013	− 0.015	− 0.014	− 0.038**	1	1
6. Family management$_{t-1}$	0.039**	− 0.054**	0.028	− 0.030	0.116***	
7. Firm size	0.044**	0.119***	− 0.048**	− 0.045**	− 0.329***	− 0.084**
8. Subsidies	0.185***	0.214***	− 0.022	− 0.008	− 0.058***	− 0.051**
9. Technological opportunity	0.001	0.184***	0.011	0.005	− 0.147***	− 0.059**
10. Firm age	0.071***	0.082***	0.041**	0.016	0.024	0.066**
11. Performance over aspiration level (historical aspirations)$_{t-1}$	− 0.001	− 0.034*	0.258***	0.461***	0.039**	− 0.073**
12. Performance over aspiration level (social aspirations)$_{t-1}$	0.005	0.009	0.027	0.104***	− 0.025	− 0.067**
13. Territorial specificities dummies	0.015	− 0.088***	− 0.023	− 0.047**	0.072***	0.063**

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table 4 presents the results of conditional logistic regression estimating the likelihood of TI output explained by R&D intensity.

Table 4

Conditional logistic regression

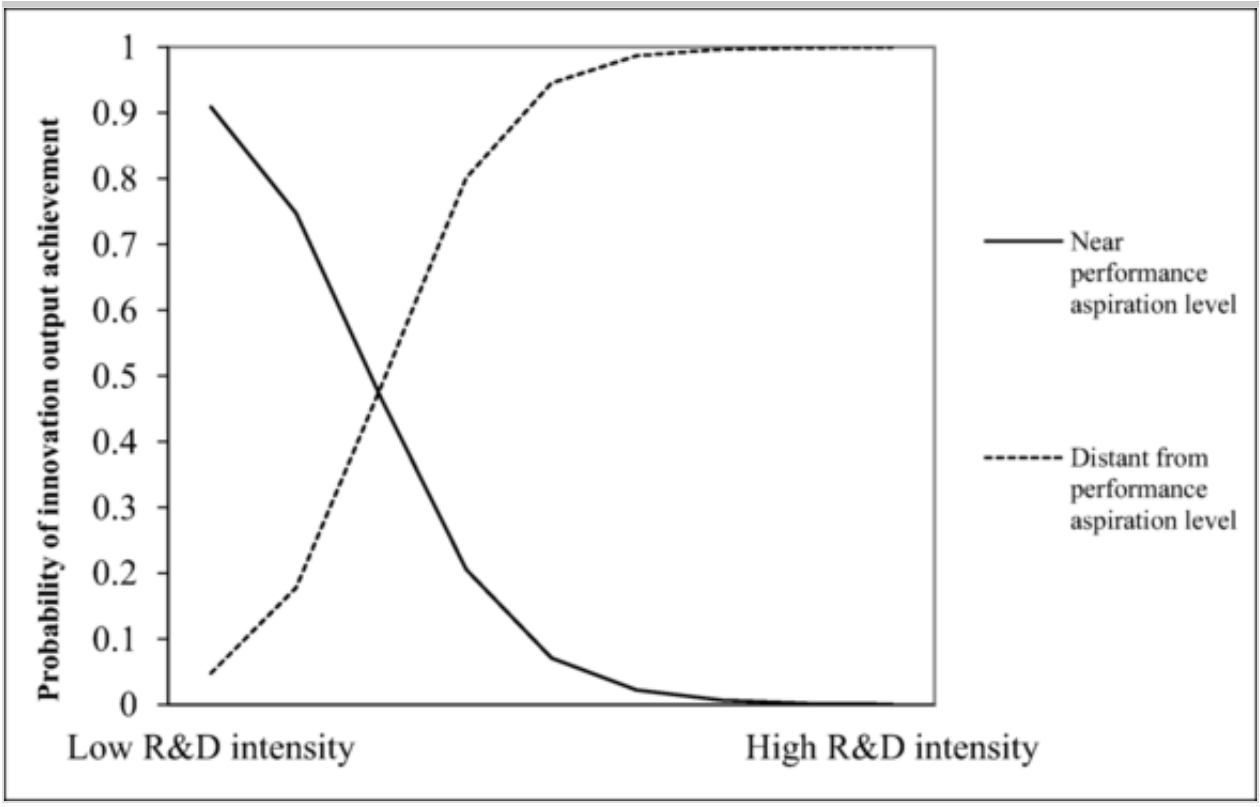
Variables	1	2	3	4	5	
Main effect						
R&D intensity $_{t-1}$ (β_1)	–	0.085** (0.035)	0.121*** (0.040)	0.121*** (0.040)	0.159*** (0.040)	0. (0.
Moderator						
Performance below aspiration level (historical aspirations)$_{t-1}$ (β_{21a})	–	–	0.259 (0.417)	–	1.138* (0.648)	–
Performance below aspiration level (social aspirations)$_{t-1}$ (β_{21b})	–	–	–	− 0.028 (0.473)	–	1. (0.
Interaction effect						
R&D intensity $_{t-1}$ × performance below aspiration level (historical aspirations)$_{t-1}$ (β_{31a})	–	–	–	–	1.749** (0.739)	–
R&D intensity$_{t-1}$ × performance below aspiration level (social aspirations)$_{t-1}$ (β_{31b})	–	–	–	–	–	1. (0.

Controls						
Firm size	0.912*** (0.103)	0.867*** (0.136)	0.419*** (0.145)	0.418*** (0.146)	0.531*** (0.163)	0.5 (0.
Subsidies	1.417*** (0.147)	1.354*** (0.167)	1.330*** (0.166)	1.329*** (0.166)	1.393*** (0.176)	1.3 (0.
Technological opportunity	0.582*** (0.195)	0.821*** (0.226)	1.097*** (0.236)	1.103*** (0.235)	1.017*** (0.253)	1.((0.
Firm age	0.160*** (0.058)	0.184*** (0.061)	0.203*** (0.066)	0.204*** (0.066)	0.232*** (0.074)	0.2 (0.
Performance over aspiration level (historical aspirations)$_{t-1}$			− 0.010 (0.336)		0.086 (0.366)	
Performance over aspiration level (social aspirations)$_{t-1}$				0.103 (0.289)		0.1 (0.
Territorial specificity dummies	Yes	Yes	Yes	Yes	Yes	Ye
Number of observation	3116	3116	3116	3116	3116	31
Log likelihood	− 1013.718	− 917.463	− 842.573	− 842.724	− 754.831	− 75
Model χ^2	354.05***	361.78***	273.26***	273.18***	295.63***	29
Pseudo-R^2	0.123	0.120	0.106	0.106	0.120	0.1
Wald test: total effects						
$(\beta_1 + \beta_{31)}$					1.908**	
$(\beta_1 + \beta_{31)}$						1.9
The effects of performance below aspiration levels on the relationship between R&I intensity and the likelihood of innovation output achievement. Robust standard erro parentheses						
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$						

We start the regression analysis including only control variables (model 1). Model 2 is a variant of model 1 in which we add the variable R&D intensity. The coefficient of R&D intensity is positive and significant in explaining the likelihood of obtaining TI. Our results are consistent with previous literature. In models 3 and 4, we add performance below aspiration levels (historical and social respectively) as independent variables. H1 proposes that performance below aspiration levels strengthens the positive effect of R&D intensity on the likelihood of obtaining TI. Models 5 and 6 of Table 4 support this hypothesis. The coefficients of interaction terms are positive and statistically significant (R&D intensity$_{t-1}$ × Performance below aspiration level, Historical aspirations: $\beta_{31a} = 1.749$, $\rho < 0.05$; R&D intensity$_{t-1}$ × Performance below aspiration level, Social aspirations: $\beta_{31b} = 1.744$, $\rho < 0.05$). Standardized values of the independent variables have been used to calculate the interaction terms in order to reduce multicollinearity concerns (Cohen et al. 2003). The results are consistent with the behavioral theory to the extent that decision-makers appear to be influenced by negative aspiration performance gaps. Figure 2 indicates that firms performing distant from historical aspirations are more likely to achieve innovation output, because as R&D intensity increases, firms become more efficient in turning R&D investments into TI. However, when firms perform near historical aspirations, increments of R&D diminish the probability of achieving TI, reducing innovation efficiency. A similar figure summarizes the moderating effect of performance below social aspiration levels on innovation efficiency (results are available from the authors).

Fig. 2

Two-way interaction effects for a logistic regression analysis. Moderator: performance below aspiration level (historical aspiration)



Hypothesis 2 posited that the level of slack strengthens the effect of performing below aspiration levels on innovation efficiency. Interestingly, the results of Table 5 indicate that the moderating effect of financial slack is positive and significant, as predicted by Hypothesis 2 (Table 5, models 2 and 4). Quantitatively, unabsorbed slack strengthens the positive effect of performance below aspiration levels (both historical and social) on innovation efficiency (Table 5, model 2 $\beta_{34a} = 1.662$, $\rho < 0.001$; model 4, $\beta_{34b} = 1.653$, $\rho < 0.001$). Accordingly, Fig. 3 shows that when firm performance is distant from historical aspirations and the level of unabsorbed slack is high, firms are more likely to achieve innovation output with lower levels of R&D investment. However, those firms with huge performance gaps and low unabsorbed slack need greater R&D investments to increase their probability of achieving TI outputs. In addition, in those firms with modest performance gaps, high levels of financial slack augment innovation efficiency slightly. On the contrary, those firms with modest performance gaps and low levels of financial slack diminish innovation efficiency. Thus, when firm performance is distant from historical aspirations and the level of unabsorbed slack is low, the relationship between R&D intensity and the likelihood of obtaining TI outputs is positive, but this relationship changes to negative when there is only a slight underperformance. This result is not only displayed in Fig. 3 but it may also be found in Table 5. In this vein, the sign change of the effect of R&D intensity in Table 5 (from

positive to negative), after including the interaction effect with underperformance and slack resources, means that the conditional direct effect of R&D intensity on innovation efficiency is negative when performance below aspiration levels and unabsorbed slack variables are equal to zero (Table 5, model 2 $\beta_1 = -0.102$, $\rho < 0.10$; model 4, $\beta_1 = -0.100$, $\rho < 0.05$). To summarize, in general terms, the level of financial slack intensifies the favorable influence of negative aspiration performance gaps on innovation efficiency. However, when there is slight underperformance and low level of slack, the relationship between R&D intensity and innovation outputs becomes negative. Thus, Hypothesis 2 is supported. A similar figure summarizes the results for performance below social aspiration levels (results are available from the authors).

Table 5

Conditional logistic regression

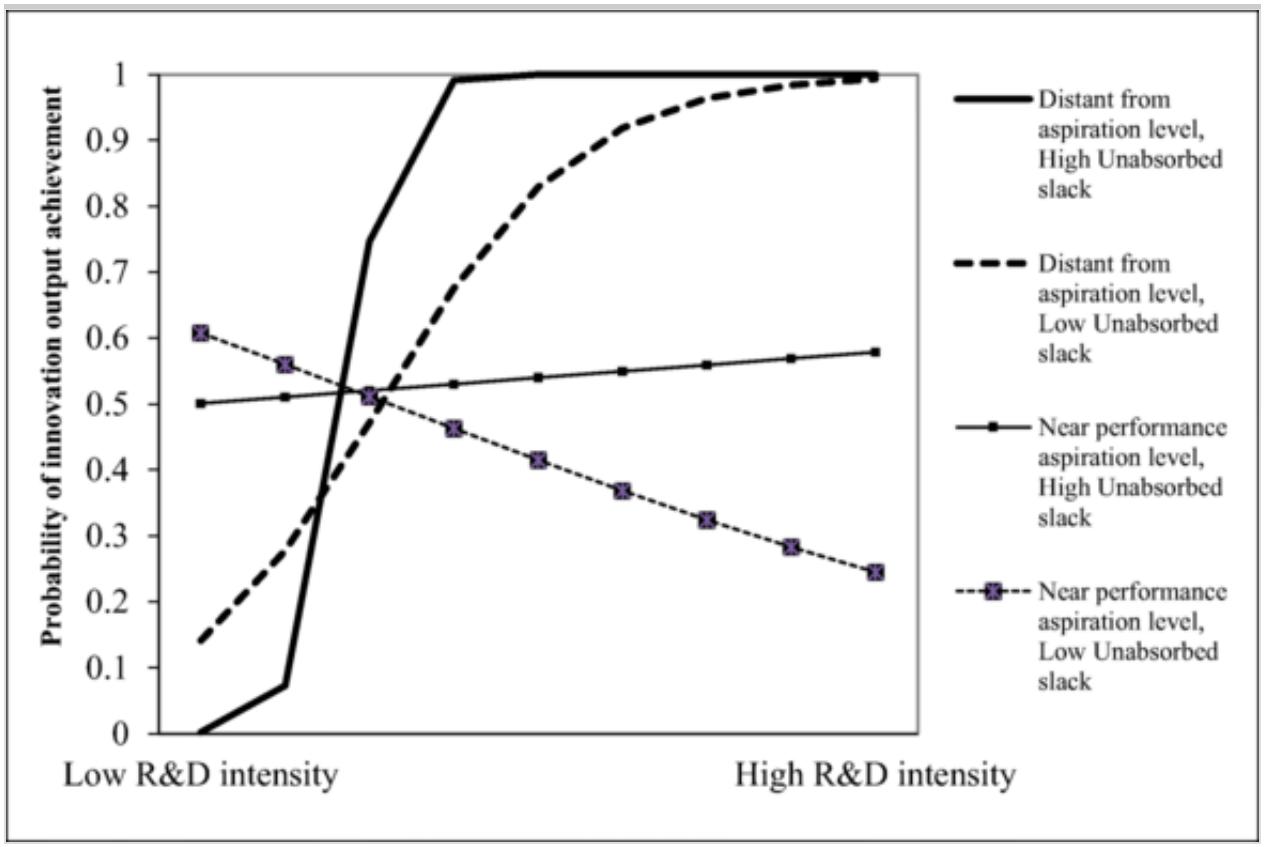
Variables	1	2	3	4
Main effect				
R&D intensity$_{t-1}$ (β_1)	0.121*** (0.040)	− 0.102* (0.055)	0.119*** (0.040)	− 0.100** (0.055)
Moderator				
Performance below aspiration level (historical aspirations)$_{t-1}$ (β_{21a})	0.257 (0.419)	2.326*** (0.796)		–
Performance below aspiration level (social aspirations)$_{t-1}$ (β_{21b}))		–	− 0.037 (0.466)	2.345*** (0.781)
Unabsorbed slack$_{t-1}$ (β_{22})	− 0.013 (0.022)	0.114*** (0.038)	0.079* (0.047)	0.101*** (0.038)
Interaction effect				
R&D intensity$_{t-1}$ × Performance below aspiration level (historical aspirations)$_{t-1}$ (β_{31a})		3.021*** (0.919)		–
R&D intensity$_{t-1}$ × Performance below aspiration level (social aspirations)$_{t-1}$ (β_{31b})		–		3.011*** (0.916)
R&D intensity$_{t-1}$ × Unabsorbed slack$_{t-1}$ (β_{32})		0.153*** (0.038)		0.151*** (0.037)

Performance below aspiration level (historical aspirations)$_{t-1}$ × Unabsorbed slack$_{t-1}$ (β_{33a})		1.628*** (0.568)		–
Performance below aspiration level (social aspirations)$_{t-1}$ × Unabsorbed slack$_{t-1}$ (β_{33b})		–		1.622*** (0.567)
R&D intensity $_{t-1}$ × Performance below aspiration level (historical aspirations)$_{t-1}$ × Unabsorbed slack$_{t-1}$ (β_{34a})		1.662*** (0.627)		
R&D intensity$_{t-1}$ × Performance below aspiration level (social aspirations)$_{t-1}$ × Unabsorbed slack$_{t-1}$ (β_{34b})				1.653*** (0.624)
Controls				
Firm size	0.418*** (0.146)	0.574*** (0.158)	0.433*** (0.146)	0.572*** (0.158)
Subsidies	1.329*** (0.166)	1.308*** (0.175)	1.324*** (0.166)	1.311*** (0.176)
Technological opportunity	1.096*** (0.236)	1.114*** (0.246)	1.089*** (0.236)	1.121*** (0.246)
Firm age	0.207*** (0.067)	0.232*** (0.075)	0.205*** (0.066)	0.231*** (0.075)
Performance over aspiration level (historical aspirations)$_{t-1}$	− 0.038 (0.338)	0.108 (0.353)		
Performance over aspiration level (social aspirations)$_{t-1}$			0.099 (0.289)	0.149 (0.329)
Territorial specificity dummies	Yes	Yes	Yes	Yes
Number of observation	3116	3116	3116	3116
Log likelihood	− 842.422	− 738.344	− 841.107	− 738.292
Model χ^2	273.60***	297.13***	279.14***	297.51***
Pseudo-R^2	0.106	0.139	0.108	0.140
Wald test: total effects				
($\beta_1 + \beta_{31a} + \beta_{32} + \beta_{34a}$)		4.734***		

$(\beta_1 + \beta_{31b} + \beta_{32} + \beta_{34b})$				4.715***
The effects of financial slack on the moderating role of performance below *historical and social aspiration* levels on the relationship between R&D intensity and the likelihood of innovation output achievement (*unabsorbed slack*). Robust standard errors in parentheses				
$*p < 0.10$; $**p < 0.05$; $***p < 0.01$				

Fig. 3

Three-way interaction effects for a logistic regression analysis. Moderators: performance below aspiration level (historical aspiration) and unabsorbed slack



Finally, according to the results shown in Table 6, the level of family management undermines the effect of performance below aspiration levels (social aspirations), on the relationship between R&D intensity and the likelihood of obtaining TI (Table 6, model 4). Particularly, we find that the coefficient of the three-way interaction $R\&D\ intensity_{t-1} \times Performance\ below\ aspiration\ level\ (Social\ aspirations)_{t-1} \times Family\ management_{t-1}$ is negative and significant ($\beta_{37b} = -1.582$, $\rho < 0.05$). The total effect test is also lower than one and significant (0.754, $\rho < 0.05$). Thus, family management negatively moderates the effect that performance below aspiration levels exerts on the

relationship between R&D intensity and the likelihood of obtaining TI. This result provides support for hypothesis H3. Furthermore, Fig. 4 illustrates how those firms with huge negative aspiration performance gaps and high levels of family management are more likely to achieve innovation output up to certain levels of R&D investments. However, beyond that level of R&D, when performance is distant from aspiration levels, firms with low family management convert R&D into TI more efficiently than firms with high levels of family management. In addition, for reduced performance gaps, a high level of family management increases innovation efficiency, while a low level of family management has the opposite effect. Moreover, the coefficient of *R&D intensity*$_{t-1}$ × *Performance below aspiration level (Historical aspirations)*$_{t-1}$ × *Family management*$_{t-1}$ (β_{36}) is negative but not significant ($\beta_{37a} = -0.583$, $\rho > 0.10$). Therefore, we cannot confirm Hypothesis 3 when firms are performing below historical aspiration levels. A more thorough analysis on the implication of the aforementioned results is discussed in the next section.

Table 6

Conditional logistic regression

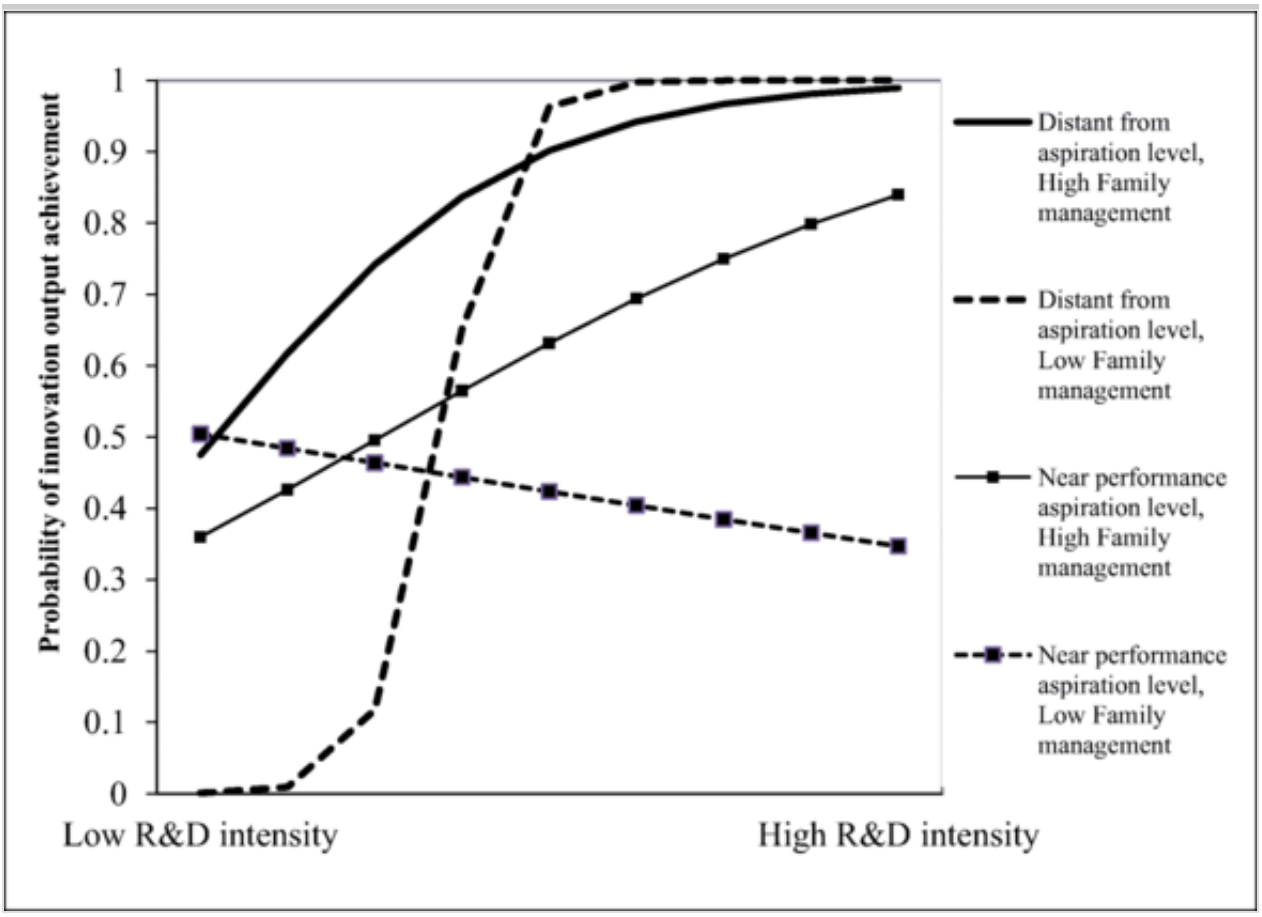
Variables	1	2	3	4
Main effect				
R&D intensity $_{t-1}$ (β_1)	0.122*** (0.042)	0.132*** (0.040)	0.121*** (0.041)	0.129*** (0.038)
Moderator				
Performance below aspiration level (historical aspirations) $_{t-1}$ (β_{21a})	0.240 (0.413)	0.893 (0.689)	–	–
Performance below aspiration level (Social aspirations) $_{t-1}$ (β_{21b})	–	–	0.273 (0.399)	0.847 (0.656)
Family management $_{t-1}$ (β_{23})	0.102** (0.049)	0.182** (0.077)	0.103** (0.051)	0.212*** (0.070)
Interaction effect				
R&D intensity$_{t-1}$ × Performance below aspiration level (historical aspirations)$_{t-1}$ (β_{31a})	–	1.978** (0.797)	–	–
R&D intensity$_{t-1}$ × Performance below aspiration level (social	–	–	–	1.972*** (0.751)

aspirations)$_{t-1}$ (β_{31b})				
R&D intensity$_{t-1}$ × Family management$_{t-1}$ (β_{35})	–	0.169** (0.074)	–	0.235*** (0.082)
Performance below aspiration level (historical aspirations)$_{t-1}$ × Family management$_{t-1}$(β_{36a})	–	0.241 (1.267)		
Performance below aspiration level (social aspirations) $_{t-1}$ × Family management$_{t-1}$ (β_{36b})	–	–		0.473 (0.501)
R&D intensity$_{t-1}$ × Performance below aspiration level (historical aspirations)$_{t-1}$ ×Family management $_{t-1}$ (β_{37a})	–	− 0.583 (1.524)	–	–
R&D intensity$_{t-1}$ × Performance below aspiration level (social aspirations)$_{t-1}$ × Family management $_{t-1}$ (β_{37b})	–	–	–	− 1.582** (0.706)
Controls				
Firm size	0.567*** (0.164)	0.539*** (0.159)	0.565*** (0.164)	0.539*** (0.162)
Subsidies	1.378*** (0.177)	1.356*** (0.176)	1.382*** (0.178)	1.368*** (0.177)
Technological opportunity	1.035*** (0.255)	1.009*** (0.249)	1.042*** (0.255)	1.015*** (0.252)
Firm age	0.217*** (0.073)	0.228*** (0.074)	0.216*** (0.073)	0.224*** (0.074)
Performance over aspiration level (historical aspirations)$_{t-1}$	0.121 (0.342)	− 0.583 (1.524)		
Performance over aspiration level (social aspirations)$_{t-1}$			0.204 (0.321)	0.189 (0.333)
Territorial specificity dummies	Yes	Yes	Yes	Yes
Number of observation	3116	3116	3116	3116
Log likelihood	− 759.748	− 745.151	− 759.624	− 741.588
Model χ^2	297.24***	292.68***	297.15***	292.60***

Pseudo-R^2	0.115	0.132	0.115	0.136
Wald test: total effects				
$(\beta_1 + \beta_{31a} + \beta_{35} + \beta_{37a})$		− 0.451		
$(\beta_1 + \beta_{31b} + \beta_{35} + \beta_{37b})$				0.754**
The effects of the level of family management on the moderating role of performance below aspiration levels on the relationship between R&D intensity and the likelihood of innovation output achievement. Robust standard errors in parentheses				
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$				

Fig. 4

Three-way interaction effects for a logistic regression analysis. Moderators: performance below aspiration level (social aspiration) and family management



6. Robustness checks

Robustness checks are performed by including the mean of performance below aspiration levels in a 3-year period, to explain, from a long-term perspective,

how performing below aspirations would impact on the conversion rate of R&D into TI (see Table 7 and Fig. 5). The results remain broadly similar to our main models, suggesting that huge negative aspiration performance gaps increase innovation efficiency. Particularly, the coefficient of the interaction *R&D intensity*$_{t-1}$ × *Performance below aspiration levels (Historical aspirations)*$_{t-1}$ is positive and slightly significant ($\beta_{31a} = 3.053$, $\rho < 0.10$) and the total effect test is also positive and significant (7.051, $\rho < 0.05$). Those results show that in the long term, underperformance has a less significant effect on innovation efficiency than in the short term. Yet, although as Fig. 5 shows, the predominance of greater gaps between performance and aspiration levels, during a long period of time (3 years in our case), increases innovation efficiency; this effect is only marginally significant.

Table 7

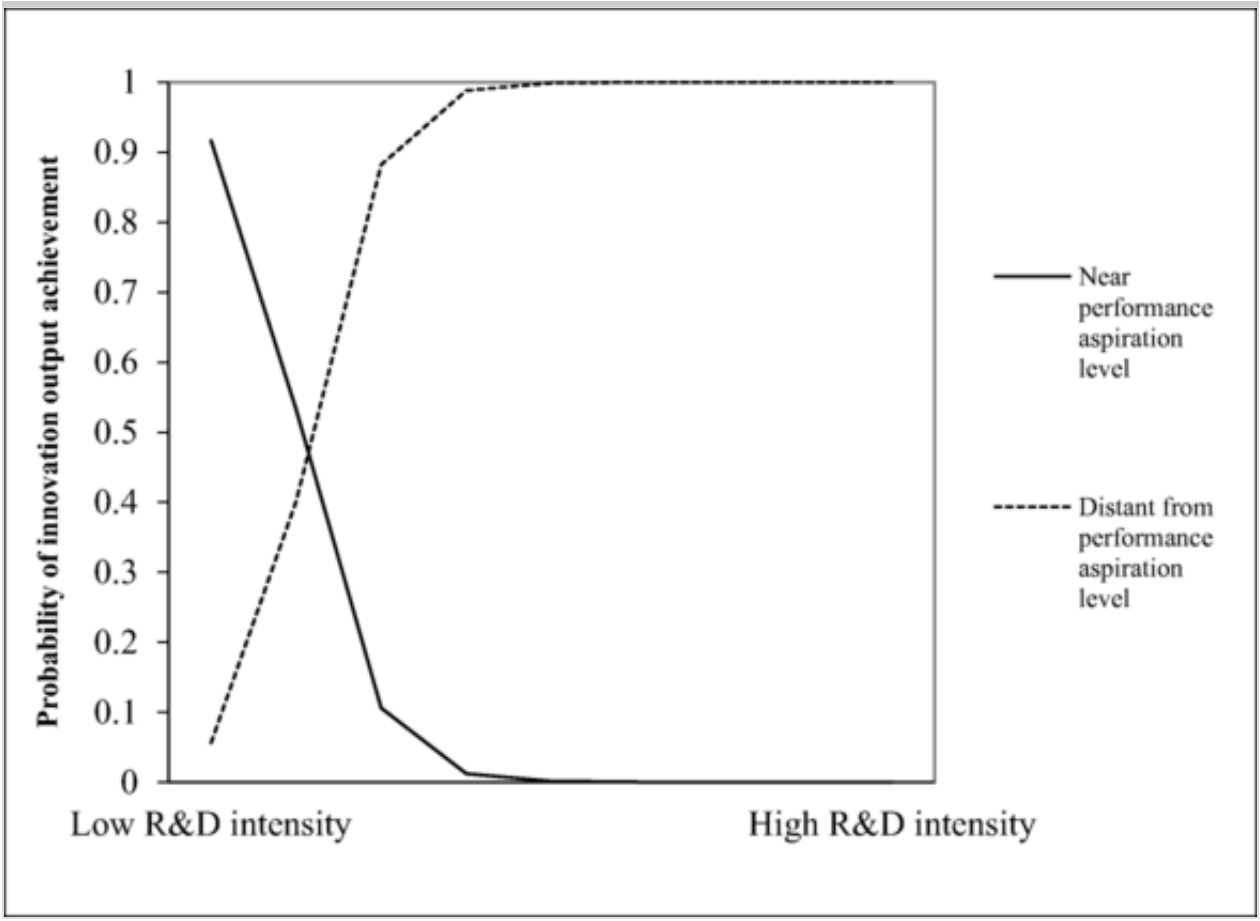
Conditional logistic regression

Variables	1	2
Main effect		
R&D intensity (β_1)	**0.097*** (0.031)** AQ11	**0.084*** (0.031)**
Moderator		
Performance below aspiration level (historical aspirations) (β_{21a})	**3.998** (1.608)**	
Performance below aspiration level (social aspirations) (β_{21b})		0.273 (0.287)
Interaction effect		
R&D intensity $_{t-1}$ × performance below aspiration level (historical aspirations) (β_{31a})	**3.053* (1.846)**	
R&D intensity $_{t-1}$ × performance below aspiration level (social aspirations) (β_{31b})		0.269 (0.204)
Controls		
Firm size	**0.867*** (0.135)**	**0.865*** (0.135)**
Subsidies	**1.378*** (0.166)**	**1.350*** (0.165)**
Technological opportunity	**0.834*** (0.225)**	**0.833*** (0.225)**

Firm age	**0.183*** (0.061)**	**0.184*** (0.061)**
Performance over aspiration level (historical aspirations)	0.276 (1.380)	
Performance over aspiration level (social aspirations)		0.233 (0.250)
Territorial specificities dummies	Yes	Yes
Number of observation	3116	3116
Log likelihood	− 910.329	− 915.198
Model χ^2	360.25***	364.44***
Pseudo-R^2	0.127	0.123
Wald test: total effects		
$(\beta_1 + \beta_{31a)}$	7.051**	
$(\beta_1 + \beta_{31b)}$		0.542
The effects of performance below aspiration levels on the relationship between R&D intensity and the likelihood of innovation output achievement. Long-term analysis ($t-1$; $t-2$; $t-3$). Robust standard errors in parentheses		
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$		

Fig. 5

Two-way interaction effects for a logistic regression analysis. Moderator: performance below aspiration level (historical aspiration). Long-term analysis



7. Discussion and conclusion

The main goal of the present study was to examine how negative performance-aspiration gaps influence innovation efficiency and the moderating effects of financial slack and family management on this relationship.

The findings show that when firms' performance falls below their aspiration levels, they react and become more efficient in converting R&D expenses into TI. Moreover, in general terms, in the R&D investment-TI relation, the influence of negative aspiration performance gaps becomes more relevant in the presence of slack and less important as family management increases.

As established in the behavioral theory, the previous literature has shown that performance below aspiration levels augments the rate of strategic changes (i.e., Greve 2011; Jung and Bansal 2009), for example by increasing R&D investments and innovation launches (Salge 2011; Vissa et al. 2010; among others). However, despite the fact that various scholars have analyzed different factors influencing innovation efficiency (Qin and Du 2017; Wang 2016) to the best of our knowledge, no study has found evidence regarding whether negative performance feedbacks trigger innovation efficiency changes. Thus, the present

study contributes to theory building (Colquitt and Zapata-Phelan 2015) by examining a previously unexplored relationship, namely the link between performing below aspiration levels and innovation efficiency. Moreover, this article introduces substantive moderators of the new proposed connection, specifically the levels of financial slack and family management, in order to describe "when" and "under what conditions" the aforementioned relationship is demonstrated. Furthermore, this study extends existing theory by investigating innovation efficiency in different time horizons. In short, drawing mainly on the behavioral theory, this study shows that performing below aspiration levels in the short and long term leads to increased innovation efficiency and that the levels of unabsorbed slack and family management significantly contribute to unfolding the core relationship. More specifically, our article contributes to the literature in several ways.

AQ12

AQ13

AQ14

First, in general terms, we found a positive and significant impact of performance below aspiration levels on innovation efficiency. However, this relationship is contingent on whether performance is distant from or near aspiration levels (Baum and Dahlin 2007). Specifically, it is shown that when there is a huge performance gap, R&D investments significantly contribute to augment the likelihood of obtaining TI, thereby increasing innovation efficiency. An explanation for this result is provided by the behavioral view. It seems that when managers detect significant deviations of performance outcomes below aspiration levels, they initiate a problemistic search to explore for solutions (Cyert and March 1963). Thus, decision-makers change the firm's overall strategy (Audia et al. 2000), increase R&D investments (Giachetti and Lampel 2010; Greve 2003a; Vissa et al. 2010), and consequently create sufficient critical mass that can contribute to further developments of innovations (Galende Del Canto and Suárez González 1999; Kancs and Siliverstovs 2016) and scale economies (Ahuja 2000). Furthermore, in those situations, firm managers implement organizational changes (Gavetti et al. 2012), generating new knowledge that increases absorptive capacity (Chaudhuri and Tabrizi 1999) and develops more inter-firm collaborative ties (Baum and Rowley 2005) which, in turn, boost innovation efficiency. Yet, when firms perform near aspirations, R&D investments will be in vain since the probability of achieving TI falls sharply, reducing innovation efficiency. It appears that slight negative-performance gaps do not heighten awareness of needs for

improvement, the problemistic search is not activated, and senior management is not likely to implement new actions to fix the modest performance gap, given that it is not considered to be a problem. Consequently, managers are not motivated to search for solutions that would raise the organization's performance closer to their aspirations (Singh 1986), despite their current practices, routines, and efforts resulting in a lower performance. In this vein, whether or not decision-makers continue to do things as always (Baum and Dahlin 2007), new R&D investments may be hampered by the existing organizational inabilities that turn out to be pernicious for innovation efficiency.

Second, the present study suggests that when performing below aspiration levels not all organizations influence innovation efficiency similarly. Negative aspiration performance gaps can endanger the firm's ordinary activity, but this repercussion is contingent on firms' resource endowment (Levinthal 1991). This study documents that financial slack shapes the way in which performing below aspiration levels affects firm innovation efficiency. Thus, in general terms, the level of slack strengthens the positive effect of performance below aspiration levels on innovation efficiency. In this vein, resources ease organizational learning, absorptive capacity, and collaboration when performance is below aspiration levels (Parida and Örtqvist 2015; Voss et al. 2008). Thus, organizations with unabsorbed slack may respond more confidently when their performance is below a status quo reference point (Bromiley 1991), by engaging in more efficient orchestration actions (Sirmon et al. 2011) to transform R&D investment into TI. Nevertheless, the moderating effect of financial slack depends on whether performance is distant from or near aspiration levels. When performance is distant from aspiration levels, any stock of financial slack contributes to increasing innovation efficiency. However, when performance is near to aspiration levels, having unabsorbed slack makes a difference in the role played by performance feedback. Thus, while possessing high levels of financial slack increases innovation efficiency, holding lower levels of slack decreases innovation efficiency. It seems that when the normal functioning of a firm is jeopardized, any amount of financial slack—low or high—is orchestrated to improve innovation efficiency and, in turn, firm performance. Yet, when managers do not perceive the performance gap as a threat and they have scarce financial slack, they decide to deploy these resources in other firm priorities, neglecting the need to improve innovation efficiency rates.

Third, our findings reveal that family managers, as the dominant coalition in

family firms (Chrisman et al. 2012; Chua et al. 1999), influence innovative behaviors (Arzubiaga et al. 2018; De Massis et al. 2013; Li and Daspit 2016). In this respect, Block (2012) did not find empirical evidence regarding the family management influence on R&D productivity. Yet, our findings go one step further highlighting that, in general terms, when performing below aspiration levels, family management exerts a negative influence on the R&D-TI conversion rate (Diéguez-Soto et al. 2016a, b; Manzaneque et al. 2017). However, as shown in Fig. 4, the moderating effect of family management is contingent upon the distance to aspiration levels. In this vein, when there is a huge performance gap, up to a certain level of R&D investments, high levels of family management have a positive effect on innovation efficiency. Yet, beyond that certain level of R&D, firms with low family involvement in management are more efficient than those with high family management. Thus, when performance is distant from aspiration levels and R&D investments are modest, family managers are aware of the performance threat and efficiently orchestrate innovative resources (De Massis et al. 2017; Duran et al. 2016; Sharma and Salvato 2011), taking advantage of well-functioning family relationships (Filser et al. 2017; Patel and Fiet 2011) and tacit knowledge (Diéguez-Soto et al. 2016a, b; Llach and Nordqvist 2010). On the other hand, when performance is far from aspirations but the level of innovative investments is considerable, family managed firms require external knowledge and professional managers (Chen and Hsu 2009; Diéguez-Soto et al. 2016a, b; Kotlar et al. 2013) to convert R&D efficiently into TI, due to their lack of expertise, skills, and resources (De Massis et al. 2015; Vandekerkhof et al. 2015). Furthermore, when performance is near aspirations, the probability of obtaining TI differs among firms with high and low family involvement in management. Thus, in the face of modest performance gap, firms with a high level of family management and consequently family commitment to their firms (Filser et al. 2017; Rojo Ramírez and Martínez Romero 2017) will make the most of their innovative resources, increasing the obtaining of TI (Diéguez-Soto et al. 2017; Duran et al. 2016) and consequently innovation efficiency, as R&D intensity increases. However, firms with low level of family involvement in management do not perceive modest performance gaps as concerns and, consequently, do not focus on enhancing innovation efficiency.

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Based on the abovementioned reasoning, our study contributes to the family business field, inasmuch as it reveals how different levels of family

involvement in management exert differential effects on performance gaps and consequently on innovation efficiency, depending on how distant they are from their performance aspirations. Moreover, the use of a continuous measure of family management enables our article to explore heterogeneity across family firms (Casillas et al. 2010; DeTienne and Chirico 2013) with regard to innovation efficiency when performance is below aspirations.

Fourth, when we extended the time interval of our analysis to analyze whether performing below aspirations over a longer period has a different effect on innovation efficiency, we found that, by and large, long-term below aspiration level performance also increases the likelihood of obtaining TI from R&D investments. In this respect, the influence of long-term underperformance on innovation efficiency is also contingent on whether long-term performance is distant from or near aspiration levels, and the results are similar to those reached for the short term. However, the results reveal that the influence of long-term underperformance on innovation efficiency is less significant than the impact of short-term underperformance. Prior literature has maintained that organizations usually suffer from myopia overlooking distant times (Levinthal and March 1993), being excessively sensitive to short-term changes in performance and generating overly short-term answers to performing below aspiration levels (Ben-Oz and Greve 2015). In this vein, firms tend to pay lower attention to the long-term, underestimating the risks of failure and inaction. This lower awareness of failure diminishes the probability of organizational change, problemistic search, and also decision-makers' commitment to make greater efforts to improve performance (Payne et al. 1980). Consequently, it appears that firms are myopic in the sense of underestimating long-term underperformance, decreasing the likelihood of addressing R&D intensity and thus scale economies, and also diminishing the probability of making organizational changes that augment absorptive capacity, new knowledge acquisition, and collaborative ties.

Finally, this paper answers the call of Duran et al. (2016) for additional research on the conversion rate, when performance aspirations are not fulfilled (Gómez-Mejia et al. 2015) and by including the influence of both financial slack and family involvement in management.

Our findings have important practical implications for policy makers, firm managers, and practitioners. First, it is of great importance to develop policies that support firms performing below aspiration levels in order to increase their

innovation efficiency. Second, we show that firms with a greater stock of financial resources (slack) are better placed to achieve greater efficiency in the use of R&D intensity. Thus, policy makers and practitioners should take into account that the firm's ability to overcome adverse situations requires the necessary level of financial slack. Finally, our study emphasizes that family firm decision-makers need to appoint industry or academic experts to deal with potential collisions between economic and emotional objectives, which might affect the conversion rates when firms perform below aspiration levels.

In spite of the interesting results of this study, our research has some limitations that also indicate interesting avenues for future research. First, internal and external R&D strategies might produce different innovation outcomes and thereby different levels of innovation efficiency (Gesing et al. 2015). Thus, analyzing different sources of R&D expenses might provide interesting results (Cruz-Cázares et al. 2010, 2013). Second, we have calculated aspiration performance gaps relying on ROA as has been done in previous literature (i.e., Ben-Oz and Greve 2015). Future studies may use other measures of performance and aspiration proxies utilized by executives, such as expected net income relative to analysts' earnings forecasts (Iyer and Miller 2008), to provide more evidence on the effect of performance feedback on innovation efficiency. Third, this study finds that negative aspiration performance gaps shapes innovation efficiency, but this influence is contingent on the levels of financial slack and family management. Future research might extend this line of enquiry further by studying the effect of other organizational factors in conditioning the impact of negative performance feedbacks on innovation efficiency. In this vein, follow-up research could advance our study by empirically analyzing other governance-moderating effects on the relationship between negative performance feedbacks and innovation efficiency, such as the role of directors on the board. Additionally, the validity of our results might be limited by our use of a specific sample of Spanish manufacturing enterprises, to the extent that the analyzed relationships may change across countries based on cultural contingencies (Hayton et al. 2002). Therefore, it would be interesting to perform a wider geographical study, taking a cross-country perspective. Moreover, our study is focused on private firms. Future research might identify theoretical and empirical differences between privately and publicly owned firms, to explain the logic of the negative performance feedback-innovation efficiency relationship. Finally, although our choice of focusing on family involvement in management is justified as senior executives have immediate power over organizational actions, differentiating between family involvement

in management and ownership (e.g., Block and Wagner 2014; Campopiano et al. 2014; Samara et al. 2017) might be helpful for future studies.

In summary, our findings imply that firm innovation efficiency is affected by negative aspiration performance gaps, being this influence contingent on whether performance is distant from or near aspiration levels. Furthermore, not all organizations performing below aspiration levels deal with innovation efficiency similarly. Rather, the levels of financial slack and family management shape the way in which performance below aspiration levels affects firm innovation efficiency. Consequently, performance feedbacks, financial slack, and family management are critical for understanding firm innovation efficiency.

References

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Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: a longitudinal study. *Administrative Science Quarterly, 45*(3), 425–455.

Almirall, E., & Casadesus-Masanell, R. (2010). Open vs. closed innovation: a model of discovery and divergence. *Academy of Management Review, 35*(1), 27–47.

Argote, L., & Greve, H. R. (2007). "A behavioral theory of the firm": 40 years and counting: introduction and impact. *Organization Science, 18*(3), 337–349.

Astrachan, J. H., & Jaskiewicz, P. (2008). Emotional returns and emotional costs in privately held family businesses: advancing traditional business valuation. *Family Business Review, 21*(2), 139–149.

Audia, P. G., & Greve, H. R. (2006). Less likely to fail: low performance, firm size, and factory expansion in the shipbuilding industry. *Management Science, 52*(1), 83–94.

Audia, P. G., Locke, E. A., & Smith, K. G. (2000). The paradox of success: an archival and a laboratory study of strategic persistence following radical environmental change. *The Academy of Management Journal, 43*(5), 837–853.

Baum, J. A. C., & Dahlin, K. B. (2007). Aspiration performance and railroads' patterns of learning from train wrecks and crashes. *Organization Science, 18*(3), 368–385.

Baum, J. A. C., & Rowley, T. J. (2005). Dancing with strangers: aspiration performance and the search for underwriting syndicate partners. *Administrative Science Quarterly, 50*(4), 536–575.

Baumann, J., & Kritikos, A. S. (2016). The link between R&D, innovation and productivity: are micro firms different? *Research Policy, 45*(6), 1263–1274.

Baysinger, B., & Hoskisson, R. E. (1989). Diversification strategy in R&D intensity in multiproduct firms. *Academy of Management Journal, 32*(2), 310–332.

Benner, M. J., & Tushman, M. L. (2002). Process management and technological innovation: a longitudinal study of the photography and paint industries. *Administrative Science Quarterly, 47*, 676–706.

Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: the productivity dilemma revisited. *Academy of Management Review, 28*, 238–256.

Ben-Oz, C., & Greve, H. R. (2015). Short- and long-term performance feedback and absorptive capacity. *Journal of Management, 41*(7), 1827–1853.

Block, J. H. (2012). R&D investments in family and founder firms: an agency perspective. *Journal of Business Venturing, 27*(2), 248–265.

Block, J., & Wagner, M. (2014). Ownership versus management effects on corporate social responsibility concerns in large family and founder firms. *Journal of Family Business Strategy, 5*(4), 339–346.

Bolton, M. K. (1993). Organizational innovation and substandard performance: when is necessity the mother of innovation? *Organization Science, 4*(1), 57–75.

Bourgeois, L. J. I. (1981). On the measurement of organizational culture in the foreign public sector. *Academy of Management Journal, 6*(1), 29–39.

Bourgeois, L. J., & Singh, J. V. (1983). Organizational slack and political behavior among top management teams. *Academy of Management Proceedings*, 43–47.

Bozeman, B., & Slusher, E. A. (1979). Scarcity and environmental stress in public organizations. *Administration and Society, 1*, 335–355.

Broekel, T. (2015). Do cooperative research and development (R&D) subsidies stimulate regional innovation efficiency? Evidence from Germany. *Regional Studies, 49*(7), 1087–1110.

Bromiley, P. (1991). Testing a causal model of corporate risk taking and performance. *Academy of Management Journal, 34*(1), 37–59.

Bromiley, P., Miller, K. D., & Rau, D. (2001). Risk in strategic management research. In M. A. Hitt, E. R. Freeman, & J. S. Harrison (Eds.), *Handbook of strategic management* (pp. 259–289). Oxford: Blackwell Publishers Inc.

Camagni, R., & Capello, R. (2013). Regional innovation patters and the EU regional policy reform: toward smart innovation policies. *Growth and Change, 44*(2), 355–389.

Campopiano, G., de Massis, A., & Chirico, F. (2014). Firm philanthropy in small- and medium-sized family firms: the effects of family involvement in ownership and management. *Family Business Review, 27*(3), 244–258.

Casillas, J. C., Moreno, A. M., & Barbero, J. L. (2010). A configurational approach of the relationship between entrepreneurial orientation and growth of family firms. *Family Business Review, 23*(1), 27–44.

Chaudhuri, S., & Tabrizi, B. (1999). Capturing the real value in high-tech acquisitions. *Harvard Business Review, 77*(5), 123–130.

Chen, W. R. (2008). Determinants of firms' backward- and forward-looking R&D search behavior. *Organizacion Science, 19*(4), 609–622.

Chen, H., & Hsu, W.-T. (2009). Family ownership, board independence and R&D investment. *Family Business Review, 22*(4), 347–362.

Chen, C., Chen, Y., Hsu, P.-H., & Podolski, E. J. (2016). Be nice to your innovators: employee treatment and corporate innovation performance. *Journal of Corporate Finance, 39*, 78–98.

Chiesa, V., & Frattini, F. (2009). *Evaluation and performance measurement of research and development: techniques and perspectives for multi-level analysis*. Cheltenham: Edward Elgar Publishing.

Chrisman, J. J., & Patel, P. C. (2012). Variations in R&D investments of family and nonfamily firms: behavioral agency and myopic loss aversion perspectives. *Academy of Management Journal, 55*(4), 976–997.

Chrisman, J. J., Chua, J. H., & Litz, R. A. (2003). A unified systems perspective of family firm performance: an extension and integration. *Journal of Business Venturing, 18*(4), 467–472.

Chrisman, J. J., Chua, J. H., & Sharma, P. (2005). Trends and directions in the development of a strategic management theory of the family firm. *Entrepreneurship Theory and Practice, 29*(5), 555–575.

Chrisman, J. J., Chua, J. H., Pearson, A. W., & Barnett, T. (2012). Family involvement, family influence, and family-centered non-economic goals in small firms. *Entrepreneurship Theory and Practice, 36*(2), 267–293.

Chua, J. H., Chrisman, J. J., & Sharma, P. (1999). Defining the family business by behavior. *Entrepreneurship: Theory and Practice, 23*(4), 19–39.

Classen, N., Carree, M., Van Gils, A., & Peters, B. (2014). Innovation in family and non-family SMEs: an exploratory analysis. *Small Business Economics, 42*(3), 595–609.

Cohen, W. M., & Klepper, S. (1996). A reprise of size and R & D. *The Economic Journal, 106*(437), 925–951.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.).

Routledge.

Colquitt, J. A., & Zapata-Phelan, C. P. (2007). Trends in theory building and theory testing: a five-decade study of the academy of management journal. *Academy of Management Review, 50*(6), 1281–1303.

Craig, J. B. L., & Moores, K. (2006). A 10-year longitudinal investigation of strategy, systems, and environment on innovation in family firms. *Family Business Review, 19*(1), 1–10.

Creenhalgh, L. (1983). Organizational decline. In S. Bacharach (Ed.), *Research in the sociology of organizations* (Vol. 2, pp. 231–276). Greenwich: JAI Press.

Cruz, C., Gómez-Mejia, L. R., & Becerra, M. (2010). Perceptions of benevolence and the design of agency contracts: CEO-TMT relationships in family firms. *Academy of Management Journal, 53*(1), 69–89.

Cruz-Cázares, C., Bayona-Sáez, C., & García-Marco, T. (2010). R&D strategies and firm innovative performance: a panel data analysis. *International Journal of Innovation Management, 14*(6), 1013–1045.

Cruz-Cázares, C., Bayona-Sáez, C., & García-Marco, T. (2013). You can't manage right what you can't measure well: technological innovation efficiency. *Research Policy, 42*(6–7), 1239–1250.

Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. USA: Wiley-Blackwell.

D'Aveni, R. A. (1989). The aftermath of organizational decline: a longitudinal study of the strategic and managerial characteristics of declining firms. *The Academy of Management Journal, 32*(3), 577–605.
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Daniel, F., Lohrke, F. T., Fornaciari, C. J., & Turner, R. A. (2004). Slack resources and firm performance: a meta-analysis. *Journal of Business Research, 57*(6), 565–574.

De Massis, A., Frattini, F., & Lichtenthaler, U. (2013). Research on

technological innovation in family firms: present debates and future directions. *Family Business Review, 26*(1), 10–31.

De Massis, A., Frattini, F., Pizzurno, E., & Cassia, L. (2015). Product innovation in family versus nonfamily firms: an exploratory analysis. *Journal of Small Business Management, 53*(1), 1–36.

De Massis, A., Audretsch, D., Uhlaner, L., & Kammerlander, N. (2017). Innovation with limited resources: management lessons from the German Mittelstand. *Journal of Product Innovation Management*, (Forthcoming). https://doi.org/10.1111/jpim.12373 .

Desai, V. (2010). Do organizations have to change to learn? Examining the effects of technological change and learning from failures in the natural gas distribution industry. *Industrial and Corporate Change, 19*(3), 713–739.

DeTienne, D. R., & Chirico, F. (2013). Exit strategies in family firms: how socioemotional wealth drives the threshold of performance. *Entrepreneurship Theory and Practice, 37*(6), 1297–1318.

Diéguez-Soto, J., Duréndez, A., García-Pérez-de-Lema, D., & Ruiz-Palomo, D. (2016a). Technological, management, and persistent innovation in small and medium family firms: the influence of professionalism. *Canadian Journal of Administrative Sciences / Revue Canadienne Des Sciences de l'Administration, 33*(4), 332–346.

Diéguez-Soto, J., Manzaneque, M., & Rojo-Ramírez, A. A. (2016b). Technological innovation inputs, outputs and performance: the moderating role of family involvement in management. *Family Business Review, 29*(3), 327–346.

Diéguez-Soto, J., Garrido-Moreno, A., & Manzaneque, M. (2017). Unravelling the link between process innovation inputs and outputs: the moderating role of family management. *Journal of Family Business Strategy*. (Forthcoming). https://doi.org/10.1016/j.jfbs.2017.11.007 .

Duran, P., Kammerlander, N., van Essen, M., & Zellweger, T. M. (2016). Doing more with less: innovation input and output in family firms. *Academy of Management Journal, 59*(4), 1224–1264.

Färnastrand, E., Hjertstrand, P., Norbäck, P.J., Persson, L., & Vasconcelos, H. (2012). Why entrepreneurs choose risky R & D projects—but still not risky enough (IFN Working Paper No. 926).

Filser, M., De Massis, A., Gast, J., Kraus, S., & Niemand, T. (2017). Tracing the roots of innovativeness in family SMEs: the effect of family functionality and socioemotional wealth. *Journal of Product Innovation Management*. (Forthcoming). https://doi.org/10.1111/jpim.12433 .

Franco, C., Pieri, F., & Venturini, F. (2016). Product market regulation and innovation efficiency. *Journal of Productivity Analysis, 45*(3), 299–315.

Freeman, C. (1976). *Economics of industrial innovation*. London: Pinter.

Fuetsch, E., & Suess-Reyes, J. (2017). Research on innovation in family businesses: are we building an ivory tower? *Journal of Family Business Management, 7*(1), 44–92.

Galende Del Canto, J., & Suárez González, I. (1999). A resource-based analysis of the factors determining a firm's R&D activities. *Research Policy, 28*(8), 891–905.

Gao, W., & Chou, J. (2015). Innovation efficiency, global diversification, and firm value. *Journal of Corporate Finance, 30*, 278–298.

Gavetti, G., Greve, H. R., Levinthal, D. A., & Ocasio, W. (2012). The behavioural theory of the firm. *The Academy of Management Annals, 6*(1), 1–40.

George, G. (2005). Slack resources and the performance of privately held firms. *Academy of Management Journal, 48*(4), 661–676.

Geroski, P. A. (1998). An applied econometrician's view of large company performance. *Review of Industrial Organization, 13*(3), 271–294.

Gesing, J., Antons, D., Piening, E. P., Rese, M., & Salge, T. O. (2015). Joining forces or going it alone? On the interplay among external collaboration partner types, interfirm governance modes, and internal R&D. *Journal of Product Innovation Management, 32*(3), 424–440.

Giachetti, C., & Lampel, J. (2010). Keeping both eyes on the competition: strategic adjustment to multiple targets in the UK mobile phone industry. *Strategic Organization, 8*(4), 2010.

Gómez-Mejia, L. R., Haynes, K. T., Núñez Nickel, M., Jacobson, K. J. L., & Moyano Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: evidence from Spanish olive oil mills. *Administrative Science Quarterly, 52*(1), 106–137.

Gómez-Mejia, L. R., Makri, M., & Kintana, M. L. (2010). Diversification decisions in family-controlled firms. *Journal of Management Studies, 47*(2), 223–252.

Gómez-Mejia, L. R., Patel, P. C., & Zellweger, T. M. (2015). In the horns of the dilemma: socioemotional wealth, financial wealth, and acquisitions in family firms. *Journal of Management*, (Forthcoming), 1–29. https://doi.org/10.1177/0149206315614375 .

Greco, M., Grimaldi, M., & Cricelli, L. (2017). Hitting the nail on the head: exploring the relationship between public subsidies and open innovation efficiency. *Technological Forecasting and Social Change, 118*, 213–225.

Greve, H. R. (2003a). A behavioral theory of R&D expenditures and innovations: evidence from shipbuilding. *The Academy of Management Journal, 46*(6), 685–702.

Greve, H. R. (2003b). *Organizational learning from performance feedback. a behavioral perspective on innovation and change (first)*. Cambridge: Cambridge University Press.

Greve, H. R. (2011). Fast and expensive: the diffusion of a disappointing innovation. *Strategic Management Journal, 32*(9), 949–968.

Guo, B., Wang, Y., Xie, X., & Shou, Y. (2015). Search more deeply or search more broadly? An empirical study of external knowledge search strategy in manufacturing SMEs. *Asian Journal of Technology Innovation, 23*(1), 87–106.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998).

Multivariate data analysis. *International Journal of Pharmaceutics* (vol. 1). New Jork: Pearson Education.

Hall, B. H., Mairesse, J., & Mohnen, P. (2010). Measuring the returns to R&D. In B. H. Hall & N. Rosenberg (Eds.), *Handbook of the economics of innovation* (Vol. II, pp. 1033–1082). Elsevier.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: the organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193–206.

Hayton, J. C., George, G., & Zahra, S. A. (2002). National culture and entrepreneurship: a review of behavioral research. *Entrepreneurship Theory and Practice, 26*(4), 33–52.

Hayton, J., Chandler, G. N., & DeTienne, D. R. (2011). Entrepreneurial opportunity identification and new firm development processes: a comparison of family and non-family new ventures. *International Journal of Entrepreneurship and Innovation Management, 13*(1), 12.

Hong, J., Feng, B., Wu, Y., & Wang, L. (2016). Do government grants promote innovation efficiency in China's high-tech industries? *Technovation, 57–58*, 4–13.

House, R., Rousseau, D. M., & Thomas-Hunt, M. (1995). The meso paradigm: a framework for the integration of micro and macro organizational behavior. In L. Cummings & B. Staw (Eds.), *Research in organizations* (pp. 71–114). Greenwich: JAI press.

Iyer, D. N., & Miller, K. D. (2008). Performance feedback, slack, and the timing of acquisitions. *Academy of Management Journal, 51*(4), 808–822.

Jansen, J. J., Van Den Bosch, F. A., & Volberda, H. W. (2005). Managing potential and realized absorptive capacity: how do organizational antecedents matter? *Academy of Management Journal, 48*(6), 999–1015.

Jung, J., & Bansal, P. (2009). How firm performance affects internationalization. *Management International Review, 49*(6), 709–732.

Kancs, d.' A., & Siliverstovs, B. (2016). R&D and non-linear productivity growth. *Research Policy, 45*(3), 634–646.

Kim, L. (1998). Crisis construction and organizational learning: capability building in catching-up at Hyundai motor. *Organization Science, 9*(4), 506–521.

Kotlar, J., De Massis, A., Frattini, F., Bianchi, M., & Fang, H. (2013). Technology acquisition in family and nonfamily firms: a longitudinal analysis of Spanish manufacturing firms. *Journal of Product Innovation Management, 30*(6), 1073–1088.

Kotlar, J., De Massis, A., Fang, H., & Frattini, F. (2014a). Strategic reference points in family firms. *Small Business Economics, 43*(3), 597–619.

Kotlar, J., Fang, H., De Massis, A., & Frattini, F. (2014b). Profitability goals, control goals, and the R&D investment decisions of family and nonfamily firms. *Journal of Product Innovation Management, 31*(6), 1128–1145.

Lane, P. J., Koka, B. R., & Seemantini, P. (2006). The reification of absorptive capacity: a critical review and rejuvenation of the construct. *Academy of Management Review, 31*(4), 833–863.

Lant, T. K. (1992). Aspiration level adaptation: an empirical exploration. *Management Science, 38*(5), 623–644.

Lavie, D., Stettner, U., & Tushman, M. L. (2010). Exploration and exploitation within and across organizations. *Academy Management Annual, 4*(1), 109–155.

Levinthal, D. A. (1991). Random walks and organizational mortality. *Administrative Science Quarterly, 36*(3), 397–420.

Levinthal, D., & March, J. G. (1981). A model of adaptive organizational search. *Journal of Economic Behavior and Organization, 2*(4), 307–333.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal, 14*, 95–112.

Levitt, B., & March, J. G. (1988). Organizational learning. *Annual Review of Sociology, 14*(1), 319–338.

Li, Z., & Daspit, J. J. (2016). Understanding family firm innovation heterogeneity. *Journal of Family Business Management, 6*(2), 103–121.

Liang, Q., Li, X., Yang, X., Lin, D., & Zheng, D. (2013). How does family involvement affect innovation in China? *Asia Pacific Journal of Management, 30*(3), 677–695.

Llach, J., & Nordqvist, M. (2010). Innovation in family and non-family businesses: a resource perspective. *International Journal of Entrepreneurial Venturing, 2*(3), 381–399.

Lubatkin, M. H., Schulze, W. S., Ling, Y., & Dino, R. N. (2005). The effects of parental altruism on the governance of family-managed firms. *Journal of Organizational Behavior, 26*(3), 313–330.

Mangena, M., & Chamisa, E. (2008). Corporate governance and incidences of listing suspension by the JSE securities exchange of South Africa: an empirical analysis. *The International Journal of Accounting, 43*, 28–44.

Mansfield, E. (1961). Technical change and the rate of imitation. *Econometrica, 29*(4), 741–766.

Manzaneque, M., Ramírez, Y., & Diéguez-Soto, J. (2017). Intellectual capital efficiency, technological innovation and family management. *Innovation: Management, Policy and Practice, 19*(2), 167–188.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organizacion Science, 2*(1), 71–87.

Marlin, D., & Geiger, S. W. (2015). The organizational slack and performance relationship: a configurational approach. *Management Decision, 53*(10), 2339–2355.

Martínez-Romero, M. J., & Rojo-Ramírez, A. A. (2016). SEW: temporal trajectory and controversial issues. *European Journal of Family Business, 6*(1), 1–9.

Martínez-Romero, M. J., & Rojo-Ramírez, A. A. (2017). Socioemotional wealth's implications in the calculus of the minimum rate of return required by family businesses' owners. *Review of Managerial Science, 11*(1), 95–118.

Miller, D., & Chen, M. (1994). Sources and consequences of competitive inertia: a study of the U.S. airline industry. *Administrative Science Quarterly, 39*(1), 1–23.

Munari, F., Oriani, R., & Sobrero, M. (2010). The effects of owner identity and external governance systems on R&D investments: a study of western European firms. *Research Policy, 39*(8), 1093–1104.

Nohria, N., & Gulati, R. (1996). Is slack good or bad for innovation? *Academy of Management Journal, 39*(5), 1245–1264.

O'Brien, J. P. (2003). The capital structure implications of pursuing a strategy of innovation. *Strategic Management Journal, 24*(5), 415–431.

Parida, V., & Örtqvist, D. (2015). Interactive effects of network capability, ICT capability, and financial slack on technology-based small firm innovation performance. *Journal of Small Business Management, 53*(S1), 278–298.

Patel, P. C., & Chrisman, J. J. (2014). Risk abatement as a strategy for R&D investments in family firms. *Strategic Management Journal, 35*(4), 617–627.

Patel, P. C., & Fiet, J. O. (2011). Knowledge combination and the potential advantages of family firms in searching for opportunities. *Entrepreneurship: Theory and Practice, 35*(6), 1179–1197.

Payne, J., Laughhunn, D., & Crum, R. (1980). Translation of gambles and aspiration level effects in risky choice behavior. *Management Science, 26*(10), 1039–1060.

Pittino, D., Visintin, F., Bau', M., & Mazzurana, P. (2013). Collaborative technology strategies and innovation in family firms. *International Journal of Entrepreneurship and Innovation Management, 17*(1/2/3), 8–28.

Qiao, P., & Fung, A. (2016). How does CEO power affect innovation

efficiency? *The Chinese Economy, 49*(4), 231–238.

Qin, X., & Du, D. (2017). Do external or internal technology spillovers have a stronger influence on innovation efficiency in China? *Sustainability, 9*(9), 1–17.

Raymond, W., Mohnen, P., Palm, F., & van Der Loeff, S. S. (2010). Persistence of innovation in Dutch manufacturing: is it spurious? *The Review of Economics and Statistics, 92*(3), 495–504.

Rojo Ramírez, A. A., & Martínez Romero, M. J. (2017). Required and obtained equity returns in privately held businesses: the impact of family nature—evidence before and after the global economic crisis. *Review of Managerial Science*, (Forthcoming), 1–31. https://doi.org/10.1007/s11846-017-0230-7 .

Rubin, I. (1977). Universities in stress: decision making under conditions of reduced resources. *Social Science Quarterly, 58*(2), 242–245.

Salge, T. O. (2011). A behavioral model of innovative search: evidence from public hospital services. *Journal of Public Administration Research and Theory, 21*(1), 181–210.

Salge, T. O., & Vera, A. (2013). Small steps that matter: incremental learning, slack resources and organizational performance. *British Journal of Management, 24*(2), 156–173.

Samara, G., Jamali, D., Sierra, V., & Parada, M. J. (2017). Who are the best performers? The environmental social performance of family firms. *Journal of Family Business Strategy*, (Forthcoming), 1–23. https://doi.org/10.1016/j.jfbs.2017.11.004 .

Schmid, T., Achleitner, A.-K., Ampenberger, M., & Kaserer, C. (2014). Family firms and R&D behavior – New evidence from a large-scale survey. *Research Policy, 43*(1), 233–244.

Sciascia, S., Nordqvist, M., Mazzola, P., & De Massis, A. (2015). Family ownership and R&D intensity in small- and medium-sized firms. *Journal of Product Innovation Management, 32*(3), 349–360.

Sharma, P., & Salvato, C. (2011). Commentary: exploiting and exploring new opportunities over life cycle stages of family firms. *Entrepreneurship Theory and Practice, 35*(6), 1199–1205.

Shimizu, K. (2007). Prospect theory, behavioral theory, and the threat-rigidity thesis: combinative effects on organizational decisions to divest formerly acquired units problemstellung grundidee hypothesen. *Academy of Management Journal, 50*(6), 1495–1514.

Singh, J. V. (1986). Performance, slack, and risk-taking in organizational decision making. *Academy of Management, 29*(3), 562–585.

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage. *Journal of Management, 37*(5), 1390–1412.

Sitkin, S. B., & Pablo, A. L. (1992). Reconceptualizing the determinants of risk behavior. *Academy of Management Review, 17*(1), 9–36.

Song, M., Benedetto, A. D., & Nason, R. W. (2007). Capabilities and financial performance: the moderating effect of strategic type. *Journal of the Academy of Marketing Science, 35*(1), 18–34.

Sorenson, O. (2003). Social networks and industrial geography. *Journal of Evolutionary Economics, 13*(5), 513–527.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. (1981). Threat-rigidity effects in organizational behavior: a multilevel analysis. *Administrative Science Quarterly, 26*(4), 501–524.

Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega, 3*(6), 639–656.

Vanacker, T., Collewaert, V., & Zahra, S. A. (2016). Slack resources, firm performance, and the institutional context: evidence from privately held European firms. *Strategic Management Journal, 38*(6), 1305–1326.

Vandekerkhof, P., Steijvers, T., Hendriks, W., & Voordeckers, W. (2015). The effect of organizational characteristics on the appointment of nonfamily

managers in private family firms: the moderating role of socioemotional wealth. *Family Business Review, 28*(2), 104–122.

Vissa, B., Greve, H. R., & Chen, W. (2010). Business group affiliation and firm search behavior in India: responsiveness and focus of attention. *Organizacion Science, 21*(3), 696–712.

Voss, G., Sirdeshmukh, D., & Voss, Z. G. (2008). The effects of slack resources and environmental threat on product exploration and exploitation. *The Academy of Management Journal, 51*(1), 147–164.

Wadhwa, A., & Kotha, S. (2006). Knowledge creation through external venturing: evidence from the telecommunications equipment manufacturing industry. *Academy of Management Journal, 49*(4), 819–835.

Wang, S., Fan, J., Zhao, D., & Wang, S. (2016). Regional innovation environment and innovation efficiency: the Chinese case. *Technology Analysis & Strategic Management, 28*(4), 396–410.

Wang, Y., Guo, B., & Yin, Y. (2017). Open innovation search in manufacturing firms: the role of organizational slack and absorptive capacity. *Journal of Knowledge Management, 21*(3), 656–674.

Winter, S. G. (2000). The satisficing principle in capability learning. *Strategic Management Journal, 21*(10), 981–996.

Yang, K. P., Chou, C., & Chiu, Y. J. (2014). How unlearning affects radical innovation: the dynamics of social capital and slack resources. *Technological Forecasting and Social Change, 87*, 152–163.

Yeh-Yun Lin, C., & Yi-Ching Chen, M. (2007). Does innovation lead to performance? An empirical study of SMEs in Taiwan. *Management Research News, 30*(2), 115–132.

Zahra, S. A., & George, G. (2002). Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185–203.

Zellweger, T. M., & Astrachan, J. H. (2008). On the emotional value of

owning a firm. *Family Business Review, 21*(4), 347–363.

Zona, F. (2012). Corporate investing as a response to economic downturn: prospect theory, the behavioural agency model and the role of financial slack. *British Journal of Management, 23*(S1), 42–57.

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[1] Following to Baysinger and Hoskisson (1989), we consider as industries with technological opportunities those such as chemicals, computers, drugs, aerospace equipment, electrical equipment, precision instruments, and photographic equipment and supplies

[2] Regions in the European Union—NUTS 2013/EU-28. Eurostat: http://ec.europa.eu/eurostat/web/nuts/overview [Accessed 1st of July of 2016]. The subdivisions are (1) Madrid (reference category), (2) Northwest of Spain, (3) Northeastern, (4) Center, (5) South, and (6) Canary Islands.